The Dock and Harbour Authority

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Editorial

The Port of Jaffa.

Jaffa, or to give it its ancient and more correct name, Joppa, will be familiar to many of our readers, assuming that they are acquainted with Biblical literature, as the place mentioned in the Book of the Acts (ix, 56 and x, 5, 6), where the Apostle Peter performed the miracle of the resuscitation of Tabitha (or Dorcas) and where he saw the remarkable vision which authorised the inclusion of Gentiles in the Christian Church. But the history of the town goes much further back than the commencement of the Christian era. Its foundation dates from a very remote period. It is mentioned in the Egyptian lists of Thothmes III (about the fifteenth century, B.C.), and in an inscription of Sennacherib (700 B.C.). Further allusion is made to it in the Book of Joshua (xix, 46) under the name of Japho and it is indicated in 2 Chronicles ii, 16, as the port to which Hiram, or Huram, King of Tyre contracted with King Solomon to send timber from Mount Lebanon, " in flotes by sea."

During the Middle Ages, Jaffa underwent many vicissitudes of fortune. It figured prominently in the Crusades, being alternatively captured by the Saracens under Saladin (1187) and recaptured by our own king, Richard I (1191). Again, at the close of the eighteenth century, Napoleon took the city by assault. And during the recent disturbances in Palestine, it has attracted public notice by reason of a series of episodes in the conflict between the Arabs and the Jews. It is of interest, accordingly, to read about the attempt now being made to revive, in some degree, the former prosperity of the place as a leading port in the Levant.

For the descriptive article on page 117 of this issue, with the plan and details in the Illustrated Supplement, as also for the photographs, we are indebted to the courtesy of Messrs. Rendel, Palmer and Tritton, the engineers responsible for the execution of the scheme of modernisation so far as finances and circumstances permit at the present time. Messrs. Rendel, Palmer and Tritton, it will be remembered, were also the engineers for the new Port of Haifa at the foot of Mount Carmel, some 60 miles to the north of Jaffa.

Jaffa is but indifferently situated for development, notwithstanding its proximity to trade routes and its associations with the Port of Jerusalem. From personal knowledge, we can testify to the exposure of the place and to the difficulties which shipping has experienced in discharging cargoes while lying a mile or so offshore. On the occasion of a call, during a visit to the eastern Mediterranean a couple of years ago, we had to land on the narrow Customs quay, mentioned in the article, by means of a ship's launch, which threaded its way between rocky ridges, just awash. While disembarking in the morning, the sea was calm under a cloudless sky. During the day, the wind freshened and at nightfall boarding the vessel from a small boat, which bobbed up and down on the waves, was a process attended by some risk and difficulty.

The accommodation provided by the re-modelled harbour is much restricted in depth and only suitable for small craft. For cargo vessels it is quite inadequate. There is a proposal, however, to extend the port by means of a large, deep-water basin to be formed in the coastal embayment on the front of the adjacent new town, Tel-Aviv. If this is carried out, it may lead to the development of the shipping activities of the port in a very marked degree, and to a notable expansion of its trade.

The Coal Industry and Port Shipments.

It is a striking illustration of the stupendous decline which has taken place in the export of British coal during the last 30 years, that in a paper on the " Transport and Distribution of Coal " read before the Institute of Transport on February 8th, by Mr. C. E. R. Sherrington, very little mention is made of the shipping aspect of the coal industry. The Paper is almost exclusively devoted to a consideration of the transport of coal by rail. Mr. Sherrington remarks on the " devastating " fall in British coal tonnage exported since 1913 and it is certainly worthy of note, if only as a regrettable reminder of former prosperity, that, in 1913, the exports of coal and allied fuel amounted in round figures to 77 million tons, while, in 1936, they had fallen to 36 million tons—a decline of over 50 per cent.

We need not discuss the series of causes which have produced so drastic a change in what used to be a predominant feature of British export trade. The Great War, of course, caused a fundamental disturbance, then came the advent of hydro-electric power, developed by coal-importing countries from their own internal water resources, and lastly, the gradual displacement of steam power by the internal combustion engine. Although there are signs of a slight revival at the present time, it has to be admitted as a melancholy and inexorable conclusion from a consideration of the economic forces in operation, that the spacious days of the British coal export trade have faded into the past, perhaps never to return.

Mr. Sherrington did, however, make one or two references to methods of coal shipments at ports in this country and in America to which it will be of interest to allude. He described how at the more efficient ports of the United States, the car is " spotted " at the foot of an elevated pier, somewhat similar to the staiths at Blyth, and is propelled upwards by a " dolly " and having reached the required elevation is there locked in position on a " dumper " which revolves the car sideways and discharges the contents on to a conveyor band which directs it into "lake vessels for transit, to Duluth perhaps, into barges to be towed to New England, or into ocean vessels destined for South America or elsewhere." The speed of shipment by this method is said to be very satisfactory and mention is made of a rate of 2,500 tons per hour at one of the Chesapeake and Ohio Railway piers at Toledo on Lake Erie. Even higher rates than these, however, are on record. The installation at Curtis Bay, Baltimore, described in the issues of *The Dock and Harbour Authority* for May and June, 1923, provides an example in the case of the *Lemuel Burrows* which loaded 11,253 tons in 3 hours 1 minute.

Mr. Sherrington notes the attention paid at American coal loading piers to the reduction of breakage. It is undoubtedly a matter of great importance, and we could have desired that he had developed this part of his Paper so that British and American anti-breakage methods might have been compared. He simply alludes to Toledo, as affording a good example of the latest progress made in this respect, without going in to details.

In size, of course, American coal cars, are generally of much higher calibre than those in this country. United States cars range in capacity from 50 to 100 tons and even more, while in Great Britain, with rare exceptions, the maximum capacity is 20 tons, and there are many wagons and coaling appliances in use which fall below this standard.

Editorial—*continued*

The one consoling feature to be extracted by port authorities from Mr. Sherrington's review is that, while tonnage by rail to London since 1923 has decreased materially, sea-borne coal and coke freights have almost doubled in quantity. Coal is described as "an ideal coastwise load," and this is not to be regretted from a national point of view, since "our merchant marine, coastwise as well as ocean, is our second line of defence in times of emergency."

Maritime Passenger Stations.

The lecture to the Institute of Transport on the above subject which is reprinted in the current issue from the Institute Journal opens out a matter deserving of consideration, not only by Shipping Companies who cater for passenger traffic, but not less by Port Managers, and, we may add, by Travel Agencies. Some port authorities affect to depreciate passenger traffic, alleging the costliness of the accommodation required, the liability of shipping companies to discontinue services at short notice, and the unremunerative financial return. In spite of these contentions, even if they are well founded, a number of continental port authorities during the past few years have under the conviction, presumably, that it is sound policy, commited themselves to expenditures ranging from several hundred thousand to a million pounds or more in providing modern and up-to-date facilities at their ports, and in equipping their maritime passenger stations with accommodation possessing a degree of artistic comfort and convenience not to be found within the limits of the British Isles.

We suggest that world travel is on the increase, and that notwithstanding the competition of airways, conveyance by sea in well appointed ships will continue to attract a large number of travellers. Cruising is now a recognised and well-established form of holiday recreation, and as facilities are increased and prices lowered, people will tend to range further afield and to travel more frequently. At any rate, it cannot be accepted that a traffic movement will develop unless adequate and satisfactory facilities are provided, and, in this respect, there seems to be a good deal of lee-way to be made up at British ports, if they are to conform to the standard set by other countries.

As regards accommodation for, and handling of, cargo vessels, British ports will bear comparison with any foreign rivals, and even surpass them in enterprise and expeditious dispatch. Why then should they not establish an equal position in regard to passenger traffic? The question is worthy of careful consideration.

Port Labour at Glasgow.

The Inquiry held at Glasgow in the early part of February into the transport industry of the port and the proposal to introduce a system of labour registration, such as is already established at certain other ports, brought out some interesting evidence and observations from witnesses in regard to the experience gained at Liverpool, Bristol and Greenock, as well as the difficulties encountered by the Ministry of Labour in dealing with a complex and thorny problem.

Clearly, the Ministry of Labour regard with concern the absence of a system of registration for dock labour, since, in their view, it admits of evasions and misrepresentations respecting insurance cards and to various subterfuges for obtaining unemployment relief in circumstances under which it is not justified, or due. In addition, it is a source of unequal treatment, and even hardship to the men, though for certain reasons the men themselves are indifferent to the advantages of systematic registration and are opposed to any change in the existing arrangement, by which they can work or not as they please, and for as long spells as they like, without inconvenient questions as to the occupation of their time.

The matter is of considerable importance to port authorities, and we reproduce in this issue an abridgment of the accounts of the Inquiry which have appeared in the Glasgow Journals up to the time of our going to press. The hearing of evidence at Glasgow is concluded for the present and the Board of Investigation is proceeding to Aberdeen to look into the question of the practice there. It will return to Glasgow for a further sitting before formulating its conclusions, upon which we may be in a position to comment in a succeeding issue.

Coastwise Shipping and the Smaller Ports.

In this number we are publishing extracts from an address on shipping developments at Norwich given at a meeting last month in the Guildhall, Norwich, by Mr. W. J. Everard, whose firm is closely associated with coastal shipping in the South and East of England.

The recent increase in the number and tonnage of sea-going vessels trading to Norwich, amounting to more than double the records of six years ago, is very remarkable, and Mr. Everard enters into a detailed explanation of the factors which have fostered so striking a development. The principal of these is undoubtedly the introduction and increasing use of the Diesel motor for coastal vessel propulsion, enabling craft of greater capacity and quite moderate draft to penetrate inland waters freely.

The improvement in coastal trade is by no means limited to Norwich, but is evidenced at a number of other places, such as Shoreham, Exeter and Gloucester. Taken as a whole, it is a significant feature of the modern trend in this class of traffic, which seems to be reviving after a period of considerable depression. Apart from the specific interests of certain of the larger ports, which regard the lesser ports in their vicinity with some amount of suspicion, if not of unfriendliness, as inconvenient local competitors, the restoration of prosperity to the smaller ports is welcome from a national point of view, since it increases the resources of the country to render effective resistance to hostile attack in time of war.

Mr. Everard's address will be read with interest by those who feel that there is still considerable scope of utility for the smaller ports.

Port Grouping.

Among the topics dealt with by Sir Lionel Warner in his Paper on "Some Considerations of Problems affecting Port Management," read before the Institute of Transport at the beginning of January, was that of the Grouping of Ports, a subject which has received a considerable degree of attention during the past few years. Inspired, no doubt by the example of the amalgamation of the railway systems of Great Britain under the Railways Act of 1921, the idea was taken up by the Royal Commission on Transport in 1929 and in their conclusions they expressed the view that "it would appear to be greatly to the public interest" that port trusts should not be confined to single ports but should control all the harbours in a particular district, but they did not go beyond a recommendation in general terms. Equally without making precise or definite proposals, Sir David Owen re-opened the matter in a paper which was delivered before the Institute of Transport in February, 1936, when he discussed the problem from various points of view and gave as his considered opinion that, whatever might transpire in any direction in connection with the future control of ports, the question of grouping must be faced. He added that while aspects of the problem must present difficulties, certain definite areas would be found with commercial and geographical conditions to admit of the formation of districts with a common interest in port facilities and development, indicating that each important river with its tributaries might be the natural nucleus of such a district. Sir Lionel, clearly, does not share the point of view of Sir David Owen, and although the former admits that grouping might help some ports, and that, if it led to the reduction in port charges the trader would benefit from an amalgamation, yet he says it would be an extremely difficult problem to solve, owing to financial conditions, local interests, and varying customs and conditions. The proposal, it will be seen, bristles with contentious points with which, at the moment, it will be inexpedient and premature to deal, as we hope, in the near future, to reprint in full the text of Sir Lionel Warner's paper, together with the discussion to which it gave rise.

Port of London Notes.

During the year 1936, 30,570 vessels arrived in the Port of London. Ocean-going ships from Empire and Foreign Ports totalled 13,784 and Coasters plying between United Kingdom ports numbered 16,786. The aggregate net registered tonnage of the vessels included in the former class was roughly double the tonnage of the coasting trade vessels. Also during the same period the weight of goods handled, amounted to 43,014,535 tons.

The Port of London Authority announce that arrangements have been made for special mooring facilities to be available in the Thames for a number of liners and other passenger vessels bringing visitors to London for the Coronation.

Provision has so far been made for fifteen vessels apart from many private yachts, etc. Positions for mooring have been allocated at points between Gravesend and London Bridge with due regard to the requirements of the normal traffic of the Port.

Mooring accommodation will be arranged for a considerable number of privately owned yachts between Greenwich and Chelsea.

PUBLISHERS' NOTE.

The Publishers desire to announce that, in response to their invitation, Dr. Brysson Cunningham has, with this number, resumed the Editorship of *The Dock and Harbour Authority*, and that he has undertaken responsibility for the future policy of the Journal and will give its readers the benefit of his wide technical experience.

It will be remembered that Dr. Cunningham was associated with *The Dock and Harbour Authority* at its inception and edited it from November, 1920 until October, 1926.

The Port of Jaffa

The Modern Revival of an Historical Seaport

THE ancient town of Jaffa, or Joppa, has figured as a seaport from time immemorial. It derived its importance from being the place of landing nearest to Jerusalem and was the centre for the trade of Palestine and a link with the sea routes to the west and the caravan routes to the east. A reef of rocks which lies roughly parallel with the shore formed a natural break-water, enclosing sufficient area of quiet water between the reef and the shore to afford shelter for the shallow draft vessels which traded to Palestine even as late as the middle of the 18th century.

The larger vessels of to-day lie at anchor, when the weather permits, about a mile from the shore, and cargo is transported between ship and quay by lighters, which are comparatively small vessels carrying from 10 to 15 tons of cargo, and discharged on shore behind the reef.

No attempt appears to have been made to preserve the reef, which for centuries had been gradually wearing away, with the result that it had become almost worn down to sea level and offered little or no protection to the lighters during stormy weather. On this account the trade carried on at the Port had been seriously affected, the worst weather coinciding with the seasonal orange trade which is Jaffa's greatest and main export.

Until the improvements, described latter, were put in hand, there had been no proper facilities for handling cargoes, practically the whole of the work being done by manual labour, and the quay consisted of a narrow strip outside the Customs House, which was situated in the most congested part of the old town.

The conditions became so irksome that the Government of Palestine decided upon making extensive improvements to the Port.

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The Development Scheme.

A scheme was prepared and approved by the Government, and constructional work was commenced in 1934. This has been carried out departmentally by the Government under the supervision of the Consulting Engineers, Messrs. Rendel, Palmer and Tritton.

The scheme adopted was to provide a safe lighterage port, equipped with quays and increased facilities for handling goods.

The main feature was an artificial breakwater to be constructed on the top of the existing reef, and much of the work there was in fact the deferred maintenance for the last few centuries of the natural breakwater of the Port.

A considerable area of protected water could thus be obtained and dredging has now been carried out to give a depth of water of 2 metres at mean sea level. Quays have been constructed on the landward side and two 7-ton and two 3-ton derrick cranes are provided.

The Breakwater.

The breakwater consists of a concrete crest bonded to the existing reef. Where necessary, fissures in the reef were cleaned and sealed with concrete and the reef trimmed to take precast dovetailed blocks or built up to mean sea level by the addition of a concrete foundation to the crest, the concrete being placed in underwater shuttering or deposited in bags.

Difficulty was encountered in obtaining a satisfactory bond between the crest and the reef, and the method finally adopted was to drill holes through the first lift of concrete well into the reef and grout in plain bars with neat cement. Tests on bars placed by this method showed a safe resistance of 15 tons per bar.

The crest was built up of pre-cast concrete blocks as mentioned, placed on the outer and inner faces and with mass concrete strengthened by old rails and steel bars. The top of the crest is 3 metres above mean sea level.

A similar design was adopted for the sea wall which had to stand as a breakwater until the completion of the reclamation.

Quays.

A false quay was added to part of the existing quay where the water was too shallow to permit of lighters working safely alongside. This was extended southward as a gravity quay, the two sections together forming the new East Quay. The South Quay, which is also of a gravity type, runs between the East Quay and the breakwater and at right angles to them. The top of all quays is 2 metres above mean sea level.

The false quay consists of timber steps leading from +1.0 m. to +2.0 m. and is carried on a steel and concrete framework anchored to the existing quay, while both the south quay and the gravity wall section of the east quay are of mass concrete construction divided into sections by precast steps running from +1.0 m. to +2.0 m.

No difficulty was encountered in founding the south quay on the reef, but considerable gaps in the reef structure were discovered along the line of the east quay. Bores put down in these gaps indicated sand and the accumulated rubbish of centuries down to at least 50-ft. below mean sea level.

On these sections the gravity wall was constructed on a consolidated rubble foundation. The first lift of concrete was divided into sections by bold vertical joints and each section was tested with kentledge loading before the superimposed concrete was poured.

Dredging.

The area of water enclosed by the breakwater and the quays is approximately 43,500 square metres (10¾ acres) in extent and this has been dredged to—2.0 m. and the entrance through the reef at the north end improved.

The dredging was carried out with Priestman whole tine grabs operated by 5-ton Smith cranes mounted on pontoons, and as the reef structure was found over a large proportion of the enclosed area it was necessary to resort to blasting as a preliminary to grabbing operations.

Moorings.

Within the sheltered basin moorings have been laid down to accommodate some 210 lighters. The whole of these are only occupied during storms, when work outside the port is impossible and the sheltered area then becomes completely filled with the lighters at their moorings. In ordinary weather conditions some of the lighters have to be withdrawn from the sheltered area in order to afford working space in the Port, and fair weather moorings for 100 lighters have been laid down to the north of the breakwater, but still within the shelter of the reef.

Reclamation.

The total area of reclamation is approximately 46,500 square metres (11½ acres), the major portion of which is bounded by the sea wall, the south quay and the south approach. This section is being developed as a dump area for timber, cement, iron and similar goods, with road and internal decauville rail services, drainage, and the provision of covering and paving of the dumps as may be necessary.

The area fronting the south quay has been developed to serve the orange traffic which comprises the bulk of the export trade.

South Transit Shed, Citrus Inspection Shed and Goods Shed.

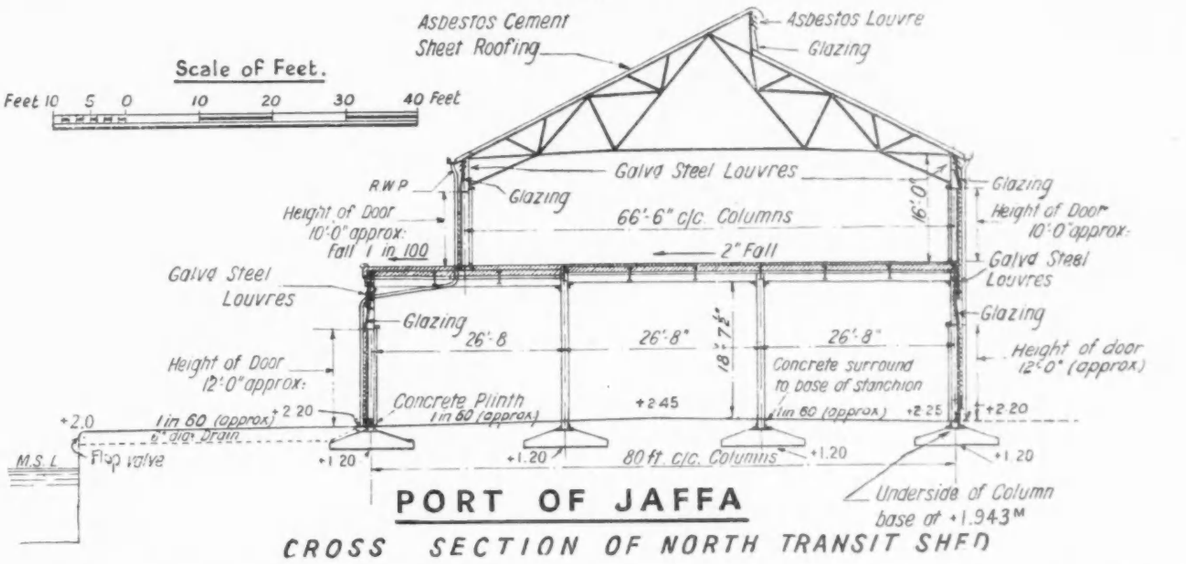
The south transit shed is a single-storey structure terminating in a two-storey office block, which has just been completed and will house the Customs and other port services, while to the rear of this shed is a subsidiary structure which will be used for the inspection of citrus fruit during the export season

THE PORT OF JAFFA

Jaffa Port Improvements.—General View of Reclaimed Area. Lighter Slipway and Repair Area on left. Customs Fence and New Coastal Road in left foreground. Site of New Goods Shed on right, showing construction of reinforced concrete floor in progress.

Jaffa Port Improvements.—General View of Lighter Basin taken during construction.

The Port of Jaffa—continued



from December to March, and as a general store during the remainder of the year.

The floor area of the south shed is 5,300 square metres with a capacity of 180,000 cases of citrus fruit, while the inspection shed has a floor area of 2,100 square metres.

Before these sheds had been completed, a further shed was authorised to meet the increasing demands of the trade in the port and this shed is now in course of erection on the reclaimed area south of the inspection shed. It is a three-bay single-storey shed with a floor area of 3,000 square metres, and is intended for the accommodation of general cased goods, also uncased goods of semi-rough or rough nature.

North Transit Shed.

As the construction of the south shed could not be commenced until the reclamation was substantially completed, the North Transit Shed was the first to be erected.

This shed is a two-storey structure fronting the east quay. It has a floor area of 2,500 square metres on the ground floor, which is equipped for handling general cargo, and 2,200 square metres on the first floor, excluding the 13-ft. 6-in. wide balcony on the quay side. The equipment includes:

(1) a humper and conveyor which serves the first floor of the old customs warehouse and the first floor of the north transit shed, via

(2) two gantries, which connect the two buildings;

(3) a canvas sling elevator serving the first floor and located in the port road; also

(4) wall cranes;
while, internally, the ground and first floors are connected by

(5) three spiral and three straight chutes and a stairway.

Jaffa Port Improvements. Sea Wall and Reclaimed Area. Retaining Wall and Wet-paved Area have been constructed to cut off broken seas overtopping wall during storms. Laying of Decauville Service Tracks and Road Paving are seen in progress.

The Port of Jaffa

Jaffa Port Improvements. View of Breakwater during Construction.

Jaffa Port Improvements. Loading Oranges into Lighters from the South Transit Shed (Season 1935-36), shortly after part of this shed had been brought into commission.

The Port of Jaffa—*continued*

In addition, a loading platform at the skew end is served by an existing 7-ton crane which has been re-sited and raised on staging, while the loading platform facing the east quay is served by a new 3-ton crane arranged with one leg fixed to the framework of the shed.

The transit sheds are all of the general type, viz., steel frame, with "Watford Handcraft" asbestos cement roofing tiles and galvanised steel weatherboard pattern side sheeting.

The steelwork for the several sheds was supplied by:—Horseley Bridge and Thomas Piggott Ltd., North Transit Shed; P. and W. MacLellan Ltd., South Transit Shed and Inspection Shed; Tees Side Bridge and Engineering Works Ltd., Goods Shed.

In addition to the equipment already detailed, the port is provided with three weighbridges located at the North and two South Gates respectively, one 3-ton crane located on the east quay between the North and South Sheds, and one 7-ton crane located on the south quay between the south shed and the breakwater, where it serves the narrow guage tracks feeding the dump areas. An existing 3-ton derrick situated adjacent to the Port Office at the north end of the port has also been raised on staging, thereby giving increased working area below. All crane and conveyor equipment is electrically operated.

Trade of the Port.

The trade of Jaffa and indeed of the whole country has increased enormously since Great Britain undertook the mandate for Palestine in 1922. In that year exports from Jaffa were 53,000 tons, imports being 103,000 tons, while in 1934 exports were 121,000 tons and imports 407,000 tons. Since the North Transit Shed with the East quay and surrounding roads were handed over to the Port Authorities a record import of 2,300 tons in one day has been established.

The principal export trade of Palestine is of course that of citrus fruit, the Jaffa orange being famous for its flavour and quality. Figures for this trade show an increase in even greater proportion. In the season 1921-22 the total number of cases exported from Jaffa was 1,141,800. In 1933-34 the quantity had increased to 3,301,211 cases, and in 1934-35 to 4,210,605 cases. No increase was recorded during the 1935-36 season, the close of which saw trade interrupted by the recent Arab strike, but the present season already promises to be a record one, not only for Jaffa but for the whole of Palestine. The trade is seasonal, export taking place between the months of November and April.

The foregoing figures serve to show the necessity for the improvements which have been undertaken and which have already proved of benefit to the Port. During the 1934-35 season with only partial use of the North Shed and East Quay, a record number of 100,800 cases of citrus fruit was shipped from the port in one day. The South Transit Shed was completed during last season and brought into use. The work of construction was seriously interrupted by the Arab strike of last year, but this season, in addition to the completion of the equipment of the North Transit Shed already referred to, the South Transit Shed and Inspection Shed are in full use and conditions in the Port are better than ever before. So great, however, has been the expansion of trade in this small country that already there have been demands for still further improvements in port facilities. The deep water harbour at Haifa which was officially opened in October, 1933, has been developing ever since and work on expansion of its facilities is still in hand. Proposals for a second deep water harbour in Palestine to serve Jaffa and the adjacent Jewish township of Tel-Aviv have been recently brought forward. Though, owing to the exposed nature of the coast at this point, such an undertaking would prove costly, the idea is under active consideration by the Authorities, and if the trade of the country continues to expand as estimated, it may before long become a virtual necessity, and the improvements which have been described may be only the initial stages of a much larger development of the Port of Jaffa.

Port of Hobart, Tasmania

Excerpts from Report of the Master Warden of Marine Board

Election.

Five candidates contested the 1935 election—two of the retiring members, Wardens W. H. Strutt and Ray Smith, with Messrs. H. E. Risby, A. R. Park, and J. P. Piggott. Warden J. R. Johnston did not seek re-election. The successful candidates were Messrs. W. H. Strutt, H. E. Risby, and Ray Smith, and they will hold office for three years.

Improvements.

Reclamation to North of Ocean Pier.—Filling has come forward in a satisfactory manner during the year—building activity having continued in the city, with the result that excavated material has been available in fairly large quantities. In addition, the Board agreed with the Vacuum Oil Co. to reclaim by contract an area of half-an-acre alongside Macquarie Point to enable the Company to erect another oil tank. Tenders were called for the work, and the lowest at 1s. 11d. per cubic yard delivered and spread was accepted. The contract is now almost completed. The area will be leased to the Vacuum Oil Co. on the same terms and conditions as its present lease is held.

Wharves.

Prince's Wharf.—The contract for reconstruction in concrete of this wharf between No. 1 and No. 2 Sheds was completed in April. Another contract for the reconstruction in the same manner of the outer end of the wharf and of the whole of Prince's Pier was let to P. C. Denholm at the price of £36,442, excluding cement, the time for completion being 17 months from the 15th August. The length of wharf and pier to be reconstructed under this contract is about 600-ft.

Fourteen new piles were driven at the inner end of this structure, beams replaced where necessary, also under-deck and sheathing.

Ocean Pier.—Passenger Deck No. 2 Shed.—The timber carrying the asphalt on this deck was found to be rotten under the standards carrying the railing. It has been made good, and the asphalt affected reconditioned. The woodwork in the doors of No. 2 Shed has received attention, and the doors are now in good order.

No. 1 Shed.—The portion of the wooden floor which rested on the ground has been taken up, and a concrete floor substituted therefor.

Brocke Street Pier.—Four new piles were driven at the outer end of this pier, and beams, gunwales, waterways, under-decking, and sheathing renewed.

Trade of the Port.

The volume of cargo passing over the Hobart wharves has been more than maintained, and the following statement shows how it was distributed:—

CARGO.	Inward. tons.	Outward. tons.
Ocear Pier	43,651	77,362
Queen's Pier	6,400	44,700
King's Pier	80,368	68,612
Elizabeth Street Pier	58,399	33,619
Prince's Wharf	55,231	40,785
	244,049	265,078

Financial.

Notwithstanding the reduction of 10 per cent. on all wharfage rates, which came into force on the 1st October, 1935, the receipts under this heading show an appreciable increase as compared with the previous year. The principal sources of revenue for the last three years were:—

	1933-34. £	1934-35. £	1935-36. £
Wharfage Rates	26,338	29,634	33,046
Tonnage Rates	6,176	6,168	6,477
Pilotage	2,198	2,286	2,600

Total ordinary receipts were £48,244, as compared with £43,589 for 1934-35 and £40,245 for 1933-34.

During the financial year, Redemption Loans were reduced by £1,763 13s. 4d., £300 paid to Sinking Fund, and five debentures of £1,000 each redeemed from the Hobart Savings Bank.

Shipping.

Tonnage visiting the port continues to increase, and a new record was created when 1,737,984 tons of shipping arrived during the 12 months ended 30th June, 1936. The crews of the vessels number 25,086. The comparison with last year and the year before is:—

	No. of Arrivals	Net Tonnage	Gross Tonnage
1933-34 ...	580	976,383	1,665,092
1934-35 ...	608	991,319	1,686,456
1935-36 ...	631	1,030,479	1,737,984

Glasgow Dock Labour Enquiry

Registration Proposed

Mr. J. M. Denholm, Deputy Divisional Controller for Scotland, speaking at the port transport inquiry which was held early in February to consider the position in Glasgow, where no system of registration is in force, said active encouragement and support was given to labour organisation schemes by the Ministry as a matter of Government policy.

A better regulation of the works at the docks was very desirable in the interests alike of the regular docker and of the general community. The Ministry could not ignore the fact that the Unemployment Insurance scheme could not be so satisfactorily applied or administered in the case of casual workers.

The arrangements made for taking unemployment benefit claims and proof of unemployment from dock workers were described by Mr. Denholm, who said that union men proved their unemployment twice daily, shortly after the morning and afternoon calls at the docks, provided they were not engaged.

The Royal Commission on Unemployment Insurance, 1931, recorded that, in their view, the heavy demands made upon the Unemployment Fund by the dock industry was due to the methods of working and to the fact that the industry was the resort of unemployed workers from other industries, and was in a large measure overstaffed.

Statistics were submitted by Mr. Denholm to show the extent to which Glasgow dockers were proving "bad risks" under the Unemployment Insurance Scheme. Over a period of 13 weeks, he said, 22 per cent. per week of the union dockers were on the average paid benefit at the rate of 16s. 2d. per man.

Quoting several cases, he said he thought they clearly revealed that it was a very common thing for dockers to obtain work for part of a week and unemployment benefit for the rest of the week, and that there were a good many cases in which dockers obtained work on three days of the week and drew benefit for the remaining three days.

During 1936 there were 21 cases of prosecution for fraud arising out of unemployment at the docks. In other cases it had not been possible to take proceedings owing to the difficulty of obtaining evidence of identity.

At the outset of the inquiry Sheriff Irvine reviewed the scheme advocated for Glasgow, and said a register of bona-fide workers and a joint-committee of control were contemplated.

Evidence was led on behalf of the Glasgow Shipowners' and Dock Labour Employers' Organisation, and Neil White, a master stevedore, gave it as his opinion that the union men objected to registration because they would have to attend at the docks every day; they feared their earnings might become known; and they feared disciplinary measures.

Various witnesses contended that registration would regularise employment and be for the good of the port, the masters, and the dockers. There was general agreement that the best work at the docks was done by union men.

Systems at Three Ports Explained.

Systems for the registration of dock labourers at present in operation in the Ports of Liverpool, Bristol, and Greenock were described as follows:—

Mr. Joseph Evans, assistant secretary of the Dock Labour Joint Committee at Liverpool, explained that the dock labour clearing-house scheme for Liverpool and Birkenhead had been set up in 1912 for the registration of labour, the payment of wages once a week through the clearing-house, the collection of National Health Insurance contributions, and the stamping of cards.

Each docker was given a tally in exchange for his National Health Insurance card, and he retained it so long as he was working or seeking work at the docks under the scheme. Since 1920 the Unemployment Insurance cards had also been deposited.

On the inauguration of the scheme, about 31,000 tallies were issued, but that number had been reduced until to-day there were 15,750 tallies in circulation. The effective personnel was placed at 14,170, as 10 per cent. was allowed for men who were sick or on compensation.

Referring to the earnings of the workers, Mr. Evans stated that the number of men paid during the quarter ended last December was 12,560, and the average weekly earnings were £2 15s. 9d., which was equal approximately to four and a half days' employment. The average earnings over the entire number of men available were £2 9s. 4d.

Mr. Evans admitted that at the week-end about 1,000 non-tallyholders were employed, owing to shortages of tallyholders at that time. It was generally accepted that the incidence of the regulations governing the payment of unemployment benefit was an important contributory cause of that shortage.

Mr. S. C. Parkin, a member of the Bristol Port Labour Committee, stated that the system adopted in Bristol in 1924 was the introduction of a record book as token of a worker's registration at the port.

The book was stamped by the employer for each day's employment and by the Employment Exchange for each day of approved unemployment. The book also showed particulars of the type of work for which a man was most suited. No man without a book would be engaged if a competent registered man was available.

Asked how this preference was enforced, Mr. Evans replied that there was little need to enforce it, but on any occasion when an employer departed from the terms of the registration agreement he was fined by a disciplinary committee of the Port Labour Committee.

The number of registered men was 2,627 at the end of last September, and of that number 19 per cent. were over 60 years of age, and 21 per cent. were under 40. They had been unable to introduce weekly payments of wages.

The scheme at Greenock was outlined by Mr. Edward Quigley, Chairman of the Greenock branch of the Transport and General Workers' Union. He stated that there was 352 men on the registration list

The scheme was inaugurated in 1924, and had been maintained since, except for a break of four months in 1928.

The men had abandoned the scheme during that period, but at the end of the four months they asked that it be restarted.

He maintained that the operation of the scheme was beneficial to the dock labourers and to the port as a whole, and that it had created greater regularity of employment among the registered men.

Evidence for the Ministry of Labour was continued by Mr. J. M. Denholm, who explained the arrangements whereby dockers were allowed to carry their unemployment insurance books so that these could be produced when the men obtained work.

When an employer encountered difficulty in getting a man to produce a book he applied to an unemployment exchange for an emergency book on which to affix unemployment contributions.

"In the majority of such cases," Mr. Denholm said "the men have been found to have given false names and addresses to the employers and when the emergency books have been returned to the exchanges it was not possible to trace or identify the insured contributor. From a recent examination it was found that from 916 emergency books received between October 1 and December 19, 1935, only 294 men could be traced."

If the worst possible construction were placed on the position, one must consider the possibility of that being done in some cases so that employment might not be discovered and an irregular claim for benefit made.

Mr. Alexander Morrison, Chief Inspector of the outdoor staff of the Department of Health for Scotland, stated that casual work of all kinds, and dock labour more so than any other, presented difficulties to the Inspectors of the Department. Formerly, difficulty arose through the removal of stamps from unemployment books, the workers apparently desiring not to indicate employment, but about three or four years ago difficulty arose when men presented National Health Insurance cards but not Unemployment Insurance books. He had found that many cards bore false names and addresses.

Some two years ago he had reason to believe that employers, through their foremen, were not sufficiently insistent on the need for the production of books and cards, but after meetings with employers, reports reaching him indicated that employers were trying to get the men to produce books. Frequently, when non-union labour was engaged, employers could not obtain the unemployment books, and on several occasions his inspectors had waited for dock labourers until the paying-off time to obtain information, but some of the men had not appeared.

He supposed the men did not wish the fact they were employed made known, and that their action was in connection with unemployment assistance or benefit of some kind. It was quite possible that the men might have proved unemployment on the day they were working. He admitted that the difficulties were almost entirely confined to non-union men, and any measure of organisation of the port which would eliminate or reduce the volume of employment of non-union men would be helpful to the Department.

Three non-union dockers gave evidence, each indicating that he obtained three days' employment during busy weeks and two days or less at other times.

The Maintenance of Waterways to Harbours and Docks*

(continued from page 114)

By RAYMOND CARPMAEL, O.B.E., M.Inst.C.E.

Report of the Discussion which followed the reading of the above Paper

THE Author, in introducing his Paper, exhibited a number of lantern slides of dredging plant.

The President, in moving the vote of thanks to the Author, remarked that he had not only dealt with a most interesting subject, but had presented a Paper that would be extremely useful both for discussion and for reference. He himself was particularly interested in it because he knew all the ports and harbours that the Author had mentioned. He had worked in the construction of some of them, and was therefore glad to hear of their subsequent history. The engineer and the contractor often left some troubles to be dealt with by the maintenance staff!

Mr. F. E. Wentworth-Sheilds remarked that in Fig. 16 (p. 113) the Author showed that the costs of the dredging for which he was responsible had been reduced since 1929 from 4.7d. per cubic yard to 2.5d. per cubic yard. Such a reduction indicated remarkable improvements in the organization.

On p. 112 the Author stated the total output in tons; that revived a question which had often been discussed, namely, was it possible to adopt a standard unit for dredging? Dredged material could be measured in cubic yards in situ or in barge, and also in tons, and it would be most convenient if one method could be standardized. He had to admit, however, that on the Southern Railway it had not been found possible to adopt one method only. At a port such as Folkestone, where there was sand, it was very difficult to take soundings and to measure in situ, because the site was exposed and because the changes in the level were very rapid. It was, however, comparatively easy to measure sand in barges, because the sand settled down quickly, the measurement obtained corresponding fairly well with the original measurement in the ground. At a port such as Southampton, on the other hand, where a very soft mud had to be dealt with, measurement in barge was most unsatisfactory. Such mud was colloidal, weighed only about 1.0 ton per cubic yard, and in its original state contained about three-quarters of its bulk of water. When that mud was dredged and filled into a barge it did not displace the water which was already in the barge but mixed with it; the resulting mixture, although perhaps only about 5 to 10 per cent. lighter than the original mud, was very more bulky. Moreover, the increase in bulk varied considerably. Generally speaking, it was found that 1 cubic yard of mud in situ became about 1.6 cubic yard in the barge. Hence, if the cost of the dredging were found to be 4d. per cubic yard in barge, the real cost per cubic yard in situ would be about 7d. On the other hand, it was comparatively easy to measure soft mud in situ; soundings could be taken both before and after dredging and the results computed with fair accuracy, provided that the work were carefully done by an experienced surveyor. For the reasons which he had stated, the Southern Railway Company adopted the cubic yard in situ for measuring materials such as soft mud, and the cubic yard in barge for hard materials such as sand. They had abolished measurement by tonnage, as it seemed to have very little value for ordinary purposes.

The Author had stated that the Great Western Railway employed bucket-ladder dredgers for the bulk of its work; the Southern Railway employed similar machines for most of its work, and he thought that on the whole they were the most useful type, as they were most adaptable and could give very large outputs. An interesting attempt had, however, been made 2 years ago to try to cheapen the dredging at Southampton, where it was very expensive because the barges had to be taken over 25 miles before they could dump their load. He had thought that the mud might possibly be removed more cheaply by stirring it up and allowing it to be washed away, but investigation had proved him to have been wrong. That investigation had, however, given very interesting information. The velocities of the currents, the salinity of the water, the rate of silting per annum, the silt-content of the water and the nature of the silt had all been studied. The latter investigation had been especially interesting, and had been carried out by Dr. Bernard Dyer, F.R.S., an agricultural chemist. He had found that the silt was very fine, 70 per cent. of the particles being less than 0.01 millimetre in size. Although it was sticky, being apparently a kind of very soft clay, it was not really a clay, as 70 per cent. of it was silica and only 5 per cent. was alumina. It also contained 10 per cent. of chalk, presumably because the rivers which flowed into Southampton Water passed largely through chalk country. The most interesting discovery had been that, though when shaken up in distilled water that fine mud settled very slowly (so slowly that after standing for 3 weeks in a glass jar there was still a very large proportion of the mud left in suspension), when it had been shaken up in salt water and allowed to stand the whole of the mud had settled within ½ hour. That showed clearly that it was useless to stir up the mud in a dock where the currents were small, as it would settle again in a very short time. His Company had therefore abandoned the idea of removing mud by that means.

Mr. M. F.-G. Wilson observed that the Author had referred at some length to the accumulation of material at an obstacle projecting from the foreshore, and had mentioned Madras and other places where there had been a good deal of deposit. He had not, however, referred to the erosion on the lee side of the obstruction, which was often much more harmful than the deposit on the weather side. At Madras there had been a great deal of trouble on the lee side of the harbour, where the beach had all travelled to the north, the material from the south, which should have replenished it, having been cut off by the projection of the breakwaters forming the harbour. Much damage had been done, and it had cost a great deal of money to build up the foreshore. Similarly, at Dover the Admiralty Pier had trapped all the material coming from the westward, and the preservation of the beach facing the town, by means of groynes and other works, had been very expensive. At Brighton the beach in front of the town was retained by groynes, but to the eastward it was disappearing, and costly works were now being built in order to protect the cliffs. It would be seen, therefore, that accumulation caused by a projection was not the only resulting problem to be dealt with.

He agreed that it was very difficult for an engineer to foresee the exact effects of interference with tidal currents. The Author had referred to the Mersey bar, and implied that it had been formed by the material brought down by the river. The river Irwell, however, which fed the upper estuary, was very small, and it did not bring down very much silt. The bar consisted of material brought up from the south by the littoral drift, with the result that in 1890, when the bar had first been cut through, it filled up again as fast as it had been dredged, owing to the northward travel of the beach, which accounted for the very large amount of dredging that had been required, as referred to in the Paper. It appeared, however, to be diminishing, and there was now less dredging at the bar than there used to be.

With regard to the Bristol Channel ports, the Author referred to the silt which was brought down by the rivers. He did not think, however, that the silting in the ports was chiefly due to silt being, at the present time, brought down by them. On the Bristol Channel foreshore there were many miles of mud flats, being accumulations of mud which had been brought down during thousands of years; the first wash of the flood tide stirred up that mud, which was then carried by the tidal currents into the neighbourhood of the various docks, where it was deposited at slack water, causing the trouble and inconvenience referred to in the Paper.

Mr. N. G. Gedye desired to call attention to two matters upon which there might legitimately be a difference of opinion. On p. 84 referring to the beach accumulation at Dungeness, the Author mentioned that pebbles from Budleigh Salterton, near Exmouth, as well as Cornish pebbles, had been picked up there, and he suggested that the Dungeness deposit consisted of "sea-borne material from the more westerly littorals of Devonshire and Cornwall." Under existing geological conditions, however, the principal source of supply of the Dungeness shingles was flint derived from the cliffs between Dungeness and Beachy Head. Relatively little came from

*Paper read before the Institution of Civil Engineers on December 8th, 1936, and published by kind permission of the Author and of the Institution.

Maintenance of Waterways to Docks and Harbours—continued

further west than Beachy Head, and he doubted whether any was derived from west of the Isle of Wight. The late Mr. W. H. Wheeler had been of opinion that the pebbles of remote origin, for instance, those from Cornwall and Devon, found at Dungeness, might have been derived from ballast contained in vessels formerly wrecked in the locality.* A list of the "foreign" pebbles found at Dungeness was given in a report of 1895.**

On p. 85 the Author, in enumerating the available methods of maintaining waterways, included the "physical removal by dredging or sluicing" of accumulations of sand and shingle, and again at the end of p. 86 he stated that under favourable conditions channels could, at least in part, be cleared by sluicing with impounded water released at or about the time of low tides. He would like to ask the Author whether he could name any harbour where sluicing was now employed with success on any important scale, excepting purely local sluicing to remove accumulations at dock-entrances and in the neighbourhood of dock-gates. The only instance mentioned by the Author where sluicing was employed, except in that very limited manner, was at Port Talbot, which seemed to be a very special case with limited affect, and the Author himself pointed out that the lowering of the dock water-level due to the discharge of sluicing water had to be balanced by pumping in channel water; under such circumstances the expedient could hardly be regarded as economical.

In former times many of the ports on the coasts of Northern France and Belgium, including Calais, Ostend, Boulogne and Dunkirk as well as similar ports elsewhere, had been provided with large sluicing-basins, but all of them had now disappeared or were disused. The tide had been allowed to flow into those basins in order to augment the natural tidal scour. The water had been shut in at high tide by gates or sluices, and had been released at low water, producing a strong current through the channel. The sluicing current, however, had rapidly lost its velocity in passing down the channel and had only been effective near the basin-outlet and down to a moderate depth below low water. The sand and silt removed by scour had been redeposited to form a bar or shallow in some other part of the entrance or approach-channel. The President would no doubt recall that at Ostend a few months after the Armistice they had experimented with using the old sluicing-basin there, but had found that material which they removed from the channel had been immediately deposited in front of the one usable quay which had been available for shipping. The introduction of powerful mechanical dredging appliances had led to the abandonment of sluicing-basins, and it would, he suggested, be unfortunate if the Author's references to sluicing were to be read by others, only partly informed of the facts, as implying more than the Author intended.

The figures given on p. 111 relating to the Mersey Docks and Harbour Board's sand-pump dredgers seemed to him to contain a numerical error. The Author stated that one of the sand-pump dredgers "is capable of dealing with some 120,000 cubic yards a day of 10 hours, working in a depth of 70 feet." The largest suction-dredger now employed by the Board in dredging sand from the bar and channels was the "Leviathan," built in 1909; that vessel had a hopper-capacity of 10,000 tons, and, he believed, filled her load in about 1 hour, but the effective dredging-capacity of the vessel per day of 10 hours could not possibly be as much as 120,000 cubic yards, or even 120,000 tons, for the time occupied in steaming to and from the place of deposit would be more than the actual dredging-time. The four sand-pump dredgers of most recent construction employed by the Mersey Docks and Harbour Board all had a hopper-capacity of 3,500 tons, and were wholly employed in removing sand from the bar and the sea and river channels. The latest of them, the "Hoyle," built in 1925, lifted 3,500 tons of sand in 50 minutes and had a maximum dredging depth of 70 feet. It should be noted that the average distance travelled by the Mersey suction-dredgers between dredging-positions and the place of deposit at sea was about 7 nautical miles. He quoted these figures from authoritative data supplied to him last year by the Board's Engineer. In connection with the Author's statement on p. 428 that 9 million tons had been dredged in 1934 from the Mersey bar and channels, he would remark that the figure had been in former years largely exceeded, the quantity of material removed having sometimes amounted to about 20 million tons in a year. As a result of the training works begun in 1908 and of intensive dredging, the depths in the Mersey approach channels had been increased over considerable areas, although the shallowest or governing depth on the site of the old bar, which in 1907 had been 26-ft. at lowest low water, had been still only 27-ft. in 1935.

It would add to the value of the cost figures given by the Author on pp. 112 and 114 if he would state the amounts which should be added to the total and unit costs in respect of interest on capital, depreciation, renewals, and repairs not already included.

Mr. G. J. Griffiths, referring to sluicing as a means of removing silt, remarked that from his experience he would advise that, unless it was unavoidable, it should not even be contemplated; the remedy was often worse than the disease. The Author justified his own use of sluicing by saying that he only wanted to put the silt somewhere where he could get at it; but how much scour would be brought about? The scour was often more troublesome than the silting it was intended to cure.

The question of littoral drift was so important that the experience of harbour engineers as to the effects of their breakwaters was always of interest, and he hoped that such engineers would give further information regarding the success or otherwise of the breakwaters erected to safeguard the entrances to various harbours. The quality of the silt was also a very important factor in each case. Did the flood-tides or the ebb-tides carry the most matter in suspension, and how did those quantities compare with that brought down by a river in flood?

An interesting instance of littoral drift was the shingle bank opposite Totland bay. For years it had existed just east of the Needles, extending to Totland bay pier, but last winter it had disappeared; he believed that that had been caused by the gales of last winter, but further information about it would be of value. Referring to Dungeness, some protective works had recently been carried out at Rye, where groynes had been put up to check the littoral drift so as to maintain the harbour entrance; protective works had also been carried out to stop the tide getting through into what was becoming a bungalow town. It would be interesting to know whether the designs of the groynes and other works had proved effective or not.

With regard to the rivers Severn and Wye, during the War he had been in command of Nos. 1 and 2 shipyards at Chepstow, and the suggestion had been put forward at one time that there should be a berthing wharf on the left bank of the Wye just at its junction with the Severn. However, it was hopeless to think of berthing ships there; so much matter was brought down by the Wye that a dredger would have to be kept there all the time. He believed the wharf had been constructed, but he doubted whether it had ever been used. The Mersey bar had been mentioned by the Author and by speakers. There was a similar bar on a much smaller scale across the entrance to the Manchester Ship Canal channel at Eastham locks; it was yet another instance of trouble arising at the junction of two streams, and it had not been found possible to prevent it. The experiment had been tried of sluicing the silt down from immediately below the entrance to the locks, but it had not proved effective and had had to be given up because the resulting scour had caused more trouble than the silt.

Mr. E. J. Buckton observed that variations in waterways were infinite, and no two were alike, but they had certain similarities which could be traced and used to practical advantage; the Author gave eight types of such similarities on pp. 84 and 85. Fig. 7 showed an unusual case, but there had been a good example of it in Canada. In the estuary of the Nelson river in Hudson bay a solid jetty had been built running out from the shore to the deep channel. However, as the jetty had been built cut so the ground had accumulated on each side of it, and very deep scour had taken place in front of it; it had finally had to be abandoned. After that failure an open pier structure had been built, ending in an island of cribwork with breakwaters to form a harbour in the estuary. The resulting conditions were as shown in Fig. 8 of the Paper, where there was an open arm with a protective structure at the end of it. As a structure it had been a success, but the scheme had been abandoned because it was unecomomic.

On p. 85, referring to Madras Harbour, the Author stated that "siltation commenced even during the construction of the work, and has caused considerable trouble and expense ever since. Unlike Ceará Harbour, that at Madras has been maintained by dredging." He did not think that was correct; very little dredging was done at Madras, and the total silting there, if no dredging were done would be 1-in. per annum. Madras Harbour had been built on a shore running north and south, with an entrance facing east. It had no sooner been built than littoral drift began to accumulate against the southern breakwater, and worked round towards the entrance. The coast a few miles to the northward had been eroded very badly, owing to the obstruction of the drift that would otherwise have replenished it. At first the harbour had not been a success, because the entrance had been entirely exposed to the waves, which always approached from directions between north-east

*W. H. Wheeler, "The Sea Coast," p. 200. London, 1902.

**"The Rate of Erosion of the Sea Coasts of England and Wales, and the Influence of the Artificial Abstraction of Shingle or other material in that Action." Fourth Report of a Committee of the British Association, p. 352. London, 1895.

Maintenance of Waterways to Docks and Harbours—continued

and south-east. A new entrance had therefore been made on the northern side, the old entrance closed, and a protective arm added as shown in Fig. 17. Since then sand had begun to

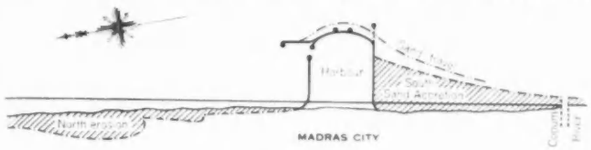


Fig. 17.

drift along the eastern side; to prevent that action a new arm had been added a few years ago, as shown dotted in Fig. 17. For the time being that had lessened the accumulation along the east side, but a stage had now been reached when the next step would have to be seriously considered. At present, therefore, Madras Harbour was really kept open by the protective action of the breakwaters rather than by dredging.

The secret of successful marine works was that the engineer ought to work with nature as far as possible. A recent case of the interception of littoral drift had occurred at the new harbour of Vizagapatam, in India, and had been fully described.* Vizagapatam was on the same coast as Madras, but the problem there was being dealt with in a different manner. The harbour was inland; the approach-channel had been dredged, and it was partly maintained by the river-action and partly by dredging. There was a heavy northward littoral drift, of the order of 2,000,000 cubic yards per annum. That had been dealt with by sinking two ships and piling stones around them, thus forming an island breakwater under whose lee a dredger could work in a sand-trap. The problem was, what was to be done with the dredged material? It would be cheaper to send it out to sea and dump it, but actually the town of Vizagapatam was north of the channel, and would be endangered by erosion. It had therefore been decided that, to avoid incurring very heavy protective works outside the town, the proper method was to provide a sand-pump dredger and to pump across the channel to the northern shore, working with the natural process. Another interesting example of trying to work with nature was the maintenance of the Port of Chittagong. The river Karnafuli had formed a sharp bend about 4 miles from its mouth, and in an ordinary river, such a bend would be expected to go on increasing in severrity until a cut-off occurred. Actually, however, there was a very strong tidal action, and the ebb-tide tended to draw the current of the river by the shortest path—that was, by the convex side instead of the concave side. A training work had therefore been required on the convex side to stabilise the channel. The action of natural forces on waterways differed in every case, and every case had to be studied individually. The Author dealt with the Great Western Railway's ports in South Wales; they were all on the same tidal river and yet they differed greatly. Whilst some of the harbours and docks of the world were on tidal rivers, others were on oceans, inland seas, great lakes and non-tidal rivers, and the briefest summary of their conditions could fill a Paper in itself.

Mr. F. M. Du-Plat-Taylor, referred to the maintenance of the approach-channels to docks by the use of sea-going sand-pump dredgers. The outstanding instances of the use of those vessels had been at the Ports of Liverpool and New York, and more recently at Bordeaux. All such vessels were self-propelling and self-loading, and were not adapted for loading independent hopper-barges. Almost the only loss of working time was that due to weather, so that the vessels had to be large and seaworthy, and the suction-pipes and connections had to be designed for working in a considerable seaway.

The original dredgers on the Mersey bar, as well as the New York dredgers, had embodied a number of patents of the late Mr. A. G. Lyster, Past-President Inst. C.E., at that time Engineer-in-Chief of the Mersey Docks and Harbour Board. One of the first of those vessels, the "G. B. Crow," had a hopper-capacity of 3,000 tons of sand and could load itself in 40 minutes. The suction-pipe was 45 inches in diameter; it was housed in a well amidships, and could work to a dredging-depth of 47-ft. The pipe sloped aft in the dredging position, but that had proved to be a mistake, as, in the event of the anchors dragging, the pipe-nozzle was forced into the ground and the pipe sometimes buckled or the joint at the top fractured. In later dredgers the pipe or pipes were fixed outside the hull and sloped forward. The hoppers were provided with hydraulically-operated cylindrical valves instead of hopper-doors. The load was often so solid that a man could walk about on it, and water had to be forced into the hoppers through special pipes to assist discharge. These dredgers could work in a beam sea, with waves of a height of about 5-ft. from crest to trough, the pipe-joint allowing sufficient lateral movement, but in a head sea there was risk of buckling the pipe. The largest dredger in the Mersey, the "Leviathan," had a capacity of 10,000 tons raised in 50 minutes, and was 465-ft. 9-in. long between perpendiculars, 60-ft. in beam and 30-ft. 7-in. deep. It had two suction pipes fitted outside the hull and sloping forward. Those vessels maintained a channel 1,000-ft. wide, originally to a low-water depth of 29-ft., but now to 30-ft. Before dredging had been begun the low-water depth over the bar was only 11-ft. In addition to the dredging, a submerged training wall or revetment had been constructed to direct and confine the currents in the low-water channel.

At the entrance to the Port of Bordeaux a deep-water channel with a low-water depth of 36-ft. and a width of 3,280-ft. was being dredged through the bar of the Gironde by sand-pump dredgers. The weather conditions on that bar were very severe, as it was exposed to westerly and south-westerly gales from the Atlantic, and it was necessary to employ vessels which could work in heavy seas. With that object, flexible suction pipes had been adopted, with ball joints at the top and with three intermediate flexible joints of the Guillouy or of other types. The pipes were fitted outside the hull, the suction nozzle being dragged astern while the vessel moved slowly ahead. The largest dredger, the "Pierre Lefort," had a daily output of 30,000 cubic metres and a hopper capacity of 3,132 tons. The vessel was 337.9-ft. long, 54-ft. in beam, and 19-ft. in loaded draught, and dredged to a depth of 65-ft., being able to work in sea with waves of 11-ft. 6-in. from trough to crest. It seemed probable that future deep-sea sand-pump dredgers would develop along those lines.

Mr. Robert Chalmers hoped to elicit from the author some further information as to the reasons for his statement, on p. 438, that trials of sand-pump dredgers "including those with the more efficient drag-suction dredgers, were not carried out, as it was not anticipated that they would result in any improvement in economic working." He himself had had some experience, under the President, of dealing with the material at Newport, Mon., in connection with the later stages of the construction of the new lock-entrance. The local material had been dredged with bucket-ladder dredgers, and, at one stage, the contents of the barges had been pumped ashore with the idea of raising the level of certain low-lying areas around the docks. Those low-lying areas had formed a settling-pond; the surplus water, after leaving it, had passed through another very large low-lying area, which had constituted a further settling-pond, and had then been discharged into the timber-float which was shown in Fig. 10. Those operations had had to be stopped because, in spite of the settling-ponds, the timber-float had silted up and had had to be dammed off, pumped out, and the silt excavated. Not only that, but the timber-float was, or had been, connected with the North Alexandra Dock by a small canal in which was the intake of the power station that supplied water under pressure to the hydraulic cranes around the quays; the dock management had complained that the silt in that water was spoiling the valves of the hydraulic cranes. He and his colleagues representing the contractor had been very sceptical, but the case had been so well established that they had had to pay for the damage caused. That was an illustration of the character of the material at Newport, Mon., and also, he submitted, of the waste and inefficiency involved in dealing with it by any method which would involve adding any more water to it than could possibly be helped. In 1922 he had been sent to dredge mud out of Dover Harbour in the area between the Prince of Wale's Pier and the Marine station, and had employed a bucket ladder dredger, and hopper barges of a capacity of 600 cubic yards each. He had started by loading those barges with 566 cubic yards each, barge measurement, which, as the bulking factor was 18½ per cent., was equivalent to 476 cubic yards in situ. When he had sent about 100,000 cubic yards to sea his soundings had told him that about 12,000 cubic yards had been redeposited on the area already dredged, and he had had to cut down the loads in the hoppers to 470 cubic yards, barge measurement, equivalent to 396 cubic yards in situ. That again showed that there was waste and inefficiency in processes which involved adding water to the material, and it was impossible to avoid doing that if a bucket-ladder dredger were employed. In contrast, he had seen a modern drag-suction hopper dredger fill its 1,200 cubic yard hopper in less than 10 minutes with mud so thick that a spade would stand upright in it, and containing in fact only 15 per cent. added water as compared with its original condition on the bottom. The dredger had had to travel 1¾ miles to the dumping ground and to return to start dredging again, but it had completed the whole cycle in 50 minutes, whereas his own hopper barges at Dover had taken over an hour each to fill alone. He had estimated that the cost of the work he had seen done with the drag suction hopper dredger was probably less than half the cost of the same work if done with a bucket-ladder dredger and hopper barges.

*W. C. Ash and O. B. Rattenbury, "Vizagapatam Harbour." Journal Inst.C.E., vol. I (1935-36), p. 235. (December, 1935).

Maintenance of Waterways to Docks and Harbours—continued

Dr. Brysson Cunningham observed that the author's remarks on the effects of the intrusion of structures into the sea from the shore-line deserved serious consideration by all harbour-engineers. Any disturbance of the normal regimen of a coast was bound to be attended by important consequences, in particular, the accumulation of material in positions where it might be detrimental to the maintenance of harbour approaches and river channels. There was another aspect of the matter, moreover, which should not be overlooked in that connection, although in the paper it was somewhat obscured by the main consideration. In describing the accretion which followed the construction of solid structures projecting from the shore in sandy localities, the author did not specifically direct attention to the fact that accretion was generally much more pronounced on one side of the obstruction than the other, nor was mention made of the tendency of the littoral current to produce, on the leeward side of the obstruction, erosion which might have serious results. Without definite explanation, Fig. 7 did not bring out that important fact; no doubt, the author was considering his subject solely from the point of view of the removal of unwelcome accumulations. At the same time, the eddying effect of the littoral current could not be disregarded, and it was to be noted that it gained in intensity if the pier, or groyne, had a returned end or curved extremity.[1] Confirmatory evidence was forthcoming from experience in various places, notably from Madras harbour, which was mentioned in the paper. Following the construction of the breakwaters, erosion had extended northwards for a length of several miles along the coast, and had had to be checked by means of stone revetments.[2] As another instance, he had been consulted about two years ago regarding the serious loss of sand from Montecito beach in Santa Barbara county, California, U.S.A., whereby the construction at an outstanding point of a pair of groynes, 200-ft. to 250-ft. long respectively, the leeward coastal frontage, formerly a fine sandy beach eminently suitable for bathing, had been denuded of sand for a distance of about 500 yards from the groynes, the level of the beach being lowered several feet until checked by a harder stratum consisting of boulders and shingle. To the windward of the groynes, a beach of sand had been built up. Accretion and erosion, in fact, were complementary phenomena, and both could be very troublesome to the harbour engineer. In the case of certain waterways, measures to counteract erosion were as necessary for their maintenance as measures in other places for the removal of excessive accretion.

At the beginning of his paper, the author seemed to stress the application of his remarks to tidal waters, as if tidal conditions were essentially associated with, or mainly responsible for, the processes he described. That, if a correct inference, was hardly the case. There was marked littoral drift and change of shore-contours along the coasts of practically tideless seas, for example in the Black Sea and the Gulf of Mexico, whilst flood-waters from the mountains of Central Europe encumbered with silt and detritus the mouths of Mediterranean rivers (where tides were also negligible), as illustrated by the deltas of the Po and Rhône. The term "silting" appeared to be used in the paper to cover both the deposit of silt, properly so called, and the transport of coastal material. The distinction was important, since silt, or mud, and fine sand were capable of being carried in suspension by water, whereas the heavier material, such as pebbles, shingle and gravel, did not float but was moved along the shore, being largely set in motion by wave-action. The accretion at Dungeness, for instance, was almost entirely of shingle, and could not be classified as silt, nor its deposition as "silting." Dr. Cunningham was hardly prepared to agree that bars at river mouths were due to "large quantities of alluvial matter eroded from the land" and brought down by rivers (p. 85). Indeed, the illustration of the Mersey bar in that connection seemed a little unfortunate, since that bar consisted mainly of sand of varying degrees of coarseness, and not of alluvium or silt.[3] In his opinion, the origin of bars was to be sought chiefly in the travel of littoral drift, which was partially arrested when it came into contact with a transverse current issuing from the mouth of a river.[4]

The latter part of the Paper, dealing with dredging operations at the Great Western ports, contained much interesting and useful information. Several questions suggested themselves, but he would only ask whether any special steps were taken to secure the retention of the fine silt in the hoppers and prevent its wasteful escape overside. Had a trial been made of the adjustable coamings used on the Liverpool hoppers, as devised and described by the late Mr. A. G. Lyster, Past-President Inst.C.E., Engineer-in-Chief to the Mersey Docks and Harbour Board?* It would be interesting to know if the good results obtained in the Mersey had been realised elsewhere.

Mr. J. N. Dawe observed that the author referred on p. 433 to the disadvantages, in some cases, of solid training works, and the success of lighter structures. Further examples would have been very useful; in that connection, the case of the lighter-port of Pamanoeken on the north coast of Java might be of some interest. The River Tjipoenagara on which that old port was situated maintained a good channel as far as the foreshore of the delta, where it had become so silted up that mud-flats extending about two-thirds of a kilometre or more from the edge of the maritime jungle, where the navigable channel ended. Beyond that the channels were tortuous and irregular, and the low-water depth at the bar had become reduced to about 25 centimetres, resulting in practical disuse of the port. A scheme had been drawn up for lighter docks to be built and dredged out a few miles distant in the middle of a long beach, as training the estuary of the river had been considered out of the question, owing to the high cost of stone locally. About 10 years ago he had been asked to advise on that scheme, and had said that, in his opinion the proposed lighter dock would need almost constant dredging, owing to littoral drift of sand, but that the estuary could be made navigable for lighters and small craft by works of a temporary or semi-permanent nature and low cost. Such works had been put in hand a year or two later, and followed the principle recommended by Mr. Buckton of assisting nature. Among the cheapest materials available were bamboos. Two lines of fences, composed of canes driven into the mud and sand with clear spaces of 2 to 4-ins. between them, were run out about 160-ft. apart, towards the sea. What was considered the most suitable direction for a straight channel was chosen irrespective of existing channels or sand-banks. Where channels of any depth were crossed, the fences were strutted by bamboos driven at an inclination and lashed with palm-fibre ropes to the walings, also of bamboo. Where banks protruded between the fences, short groynes of the same materials were used to direct the current and expedite erosion. Where wave-action was considerable, the fences were strengthened by driving king-piles and struts of young teak trees, and additional fences or groynes of shorter length were made at an angle to check the waves and littoral drift caused by the east monsoon, during which most erosion and drift took place. These, being of open construction, caused sand to deposit on their lee sides. The effect was that, during the first wet season, banks of silt were formed close up to the outsides of the two main fences as far out as they were driven, cross-channels of depths of 12-ft. being filled sometimes by a single flood. Those banks were consolidated by seedling trees of suitable kinds, some planted and some self-sown. In two years there was a thick growth of scrub on each side of the channel, and there was no necessity to maintain further the first part of the fences. The river scoured out its own channel to a sufficient depth to allow of the required navigation. The works had been extended each year to a diminishing extent as deeper water was reached, and when experience of the local conditions had shown the best positions of the secondary fences or groynes, a channel navigable at all stages of the tides had been, and still was, maintained throughout the wet and dry seasons, its length being about 2 kilometres from the original starting point. A few other precautions had had to be taken, but the total cost had been extremely low, and no dredging had been necessary.

Mr. R. F. Hindmarsh, referring to the author's statement that wherever an engineer created a harbour in tidal waters, thereby causing interference with the littoral drift, he would sooner or later have to take steps to preserve the necessary depth of water for safe navigation, stated that one of the main objects in view in the design of the works at the River Tyne entrance had been the removal of the old bar, which, before the construction of such works, existed across the entrance to the river and had over it only about 6-ft. of water at L.W.O.S.T. There was now a depth of 30-ft. at L.W.O.S.T. and little if any dredging would be required to maintain that depth if it were not necessary to maintain a straight entrance-channel; the main current on both flood and ebb tides, however, followed a curved track to the south, and a shoal formed on the north side of the channel which was removed by dredging for a few weeks every two or three years. The littoral drift was from north to south, and, although the breakwaters extended on the north side half-a-mile and on the south side one mile from the original shore-line, accretion had only

1 Brysson Cunningham, "Harbour Engineering" (3rd edition), pp. 33 and 34. London, 1928.

2 Sir Francis Spring, "Coastal Sand-Travel near Madras Harbour." Minutes of Proceedings Inst.C.E., vol. cxciv. (1912-13, Part IV.), p. 153.

3 There was some admixture of mud on the outer slopes: the coarsest and cleanest sand was found on the inner slopes (A. G. Lyster, "Dredging Operations on the Mersey Bar," British Association Meeting, 1895).

4 Brysson Cunningham, "Harbour Engineering," p. 347. London, 1928.

*Annales des Travaux Publics de Belgique, vol. v. (October), 1898.

Maintenance of Waterways to Docks and Harbours—continued

occurred on the south side of the south breakwater, and no interference with navigation had been caused by that accretion.

Mr. Ernest Latham found the Paper of particular interest to him, especially in regard to those portions dealing with silting questions at riverine harbours, and also because the author referred to the Paper by his late Partner, Mr. A. E. Carey, on the sanding-up of tidal harbours. Since the reading of Mr. Carey's Paper, however, as the result of experience he had ceased to agree with some of the views expressed therein. For example, he would not agree to Fig. 7 as being a proper representation of the arrest of littoral drift by a groyne. His own experience was that on the lee side of most groynes there was nearly always definite erosion to a much greater extent than shown in that diagram, except under the temporary reversal of littoral drift due to changes in the direction of the wind. However, he entirely agreed with Fig. 4, as it represented in diagrammatic form the cross-channel port of Newhaven, which was notably safe, and where the construction of the outer breakwater seemed to have been an entirely successful means of keeping the entrance clear with a minimum of dredging; the port could generally be used by cross-channel steamers at periods when the larger ports of Dover and Folkestone were temporarily out of commission owing to heavy weather.

The author's statements in regard to the conditions at Dungeness had probably been true 10 years ago, but did not properly describe the position to-day. The littoral drift passinto Rye Bay from Hastings round Fairlight Cliffs had now almost entirely ceased, and it had been the recent starvation of Rye Bay's natural shingle supply that caused the breach at Winchelsea in 1933 by inundation of the sea. The consequent expenditure on sea defence works carried out by him on that site for the Catchment Board concerned reached nearly £200,000. Further, instead of accreting at the moment, the Dungeness formation was being rapidly eroded on the western side, and the "Ness" was tending to form a hook towards Sandgate. Even Littlestone, on the eastern side, had lost much shingle recently, and the foreshore had been lowered by several feet, necessitating the entire reconstruction of about 1 mile of the existing sea defences there.

The dredging by the Mersey Docks and Harbour Board in Liverpool bay was, of course, a classic example of heavy costs in maintaining the entrance to a riverine port. In 1927, when advising the Lancashire County Council on the question of coast erosion in Liverpool Bay, he had had occasion to study the matter, and the author would no doubt be interested to hear that the quantity dredged was as high as 17 million tons in 1909. The figure had subsequently fallen to an average of 4 million tons per year, so that it would appear from the author's figure of 9 million tons in 1934 that siltation was again on the increase in Liverpool Bay.

The author did not apparently refer specifically to any trouble at the small harbour of Burry Port, now owned by the Great Western Railway Company. Immediately before the War the original owners of the harbour, the Burry Port and Gwendraeth Valley Railway Company, had been very much concerned with the silting up of Burry Port, and from surveys he had made on their behalf the harbour at that time had appeared to be in danger of total eclipse. From such records as were available it appeared that the Burry inlet had three channels passing through vast accumulations of sand. One of them was always the main channel, but from an examination of records a change of channels seemed to occur about three times in a century; at the time of his investigations, the north channel had been closing and the middle channel had been opening, tending to leave Burry Port more or less high and dry on the north side of the inlet. In 1914 the rate of accretion immediately to the southwest of the harbour entrance along the foreshore length of 1,600-ft. had been as much as 50,000 cubic yards per year. Dredging against accretion on that scale had seemed rather a hopeless proposition for so small a harbour, and an extension of the western breakwater had been recommended. The Company, however, had come to the conclusion that they could not spend the sum involved, and it would be of interest to know what was the present position at Burry Port, and whether the Great Western Railway had extended the western breakwater in the manner suggested.

With regard to siltation, one point had now become of importance in England; namely, that for land drainage purposes the new Catchment Boards functioning under the Land Drainage Act of 1930 were doing much up-river dredging nominally for drainage purposes, although actually it frequently resulted in improved navigation to small inland ports. The effect on the ports at or near the entrance of the river was adverse in cases where vessels took the ground at low tide. A present instance of that effect was the difficulty being experienced at Sutton Bridge, near the entrance of the river Nene into the Wash, where the increased flow of ebb and flood tide due to the increased up-river tidal compartment caused by dredging appeared definitely to have disturbed shipping berthages just below the Sutton Bridge swing-bridge. At Sutton Bridge there was an example that should be a warning to all maritime engineers. Towards the end of the last century large sums of money had been spent on excavating a large dock in the Fens, with approach-works into the River Nene. The dock had been opened to shipping for two months only, and as the dock company could not cope with the dredging, the site was now completely filled up and formed a golf course.

Mr. B. D. Richards observed that the littoral drift that occurred on the Dead Sea might be of interest. He had recently carried out investigations in connection with proposed development works there, and as the latter included small harbours or jetties at both ends, the question of littoral drift was important. The Dead Sea was 45 miles long, with a maximum width of 10 miles, and lay north and south. It was divided by the El Lisan Peninsula into two arms, of which the southern, 15 miles long, was very shallow. The sea received the inflow of the River Jordan and of several large wadis, but there was no outlet, and the inflow was disposed of by evaporation, giving rise to periodic variation of sea level. The last peak level occurred in 1929, since when there had been a fall if about 10-ft. There was also an average seasonal variation of 2-ft., the maximum occurring during or after the winter rains. Shingle-beds occurred along the western and northern shores; the origin of the shingle was evidently the disintegrated limestone of the western hills and the stones in the marl-beds surrounding the sea, and it was brought down in considerable quantity by heavy floods in the wadis. The prevailing winds were northerly and southerly; coinciding with the lie of the sea, they caused a southerly drift at the south end and a northerly drift at the north end, and the latter drift carried the shingle along the west shore and round the north shore. It was noticeable that the shingle tended to form regular beaches which in some places projected as spurs into the sea. With a falling sea, those beaches showed ridges marking the high-water level of the preceding winter. The littoral drift being due to wind action, it seemed probable that those spurs originated from deflexion of the wind caused by irregularities in the line of the coastal cliffs. Once a spur had commenced to form, its growth was very rapid, as was shown by the fact that a small jetty at the south end, built out from one of those spurs, was, though of open construction, completely silted-up in a short time. At the north end, with longer fetch and greater depth of water, there was greater wave-action than at the south end, and 6-ft. waves had been measured on the north shore. That caused a considerable travel of shingle along the north-west and north shores. Various jetties in that district, of open construction, showed no heavy accumulation of shingle against them, but a partially-closed structure had acted as a groyne and the shingle had banked up against it. Owing to the fact that the Dead Sea was tideless and that the level had been steadily falling for several years, it afforded a good opportunity of studying the subject of littoral drift under wind action.

The author, in reply, remarked that Mr. Wentworth-Sheilds had raised the most important question arising from the Paper—that of a standard unit or method of measurement for dredging. The ton unit was that required by the Great Western Railway Company's accountants—possibly because of its extremely remote relationship with that familiar railway cost unit, the "ton-mile." The reduction in working costs, achieved mainly by centralisation, was indicated in the Paper. Dredging, carried out departmentally, had as its main object the conservation as economically as possible of navigable depths, the actual method of measurement being immaterial. Should such work be undertaken by contract, however, the circumstances were entirely different and the method of measurement became of supreme importance. In the author's opinion, whilst no hard-and-fast rule could be laid down, the subject was of sufficient importance to justify some investigation by The Institution as to the possibilities of standardisation of measurement of materials to be dredged, whether "in situ" or "in barge." The Great Western Railway Company was at present carrying out investigations with the object of establishing more closely than at present the relationship between accurate measurements in barge and in situ.

In regard to the points raised by Mr. Wilson, he had indicated in the Paper the effects of disturbance of the natural balance of quantities occasioned by the construction of harbour works, involving accretion of material in excess of requirements at some places, and reduction in the supply of such material at other places where it was necessary to maintain the stability of harbours and their entrances. Although the Paper was mainly concerned with the maintenance of navigable depths at the ports discussed, the leeward-side erosion, although not actually affecting those ports to any material extent, was a question of extreme importance. As an example, the construction of the South Devon Railway at the base of the cliffs between Dawlish Warren and Teignmouth

Maintenance of Waterways to Docks and Harbours—continued

had undoubtedly checked erosion of the foreshore, and had adversely affected the foreshore of the estuary of the River Exe from Dawlish Warren to Exmouth, where erosion was in excess of accretion and was at the present time accumulative. Harbour engineers fully realised that where accreted material was artificially collected (for example, by groynes or breakwaters) some reduction in the supply of material would occur elsewhere. It was quite impossible to deal adequately with that subject in such a Paper as the present.

It was evident from Mr. Gedye's remarks that there were differences of opinion as to the source of accretion at Dungeness. The source of the accretion in a particular case was not, however, of such importance as the principle that any projection from the foreshore would intercept littoral drift.

In general, sluicing could only result in local movement of silted material to sites from which it could be more economically removed. The only G.W.R. port where really useful results were obtained by sluicing is Port Talbot. At Burry Port, however, where the shipments were not comparable with those at Port Talbot, useful sluicing work was done, although the old sluicing pond had for some years been out of action.

He agreed with Mr. Gedye that the effective dredging capacity of the "Leviathan" was less than that given on p. 111.

He had purposely refrained from giving particulars of other than working costs, including repairs under £100, but had indicated the relationship, so far as his Company was concerned, between working repairs and heavy repairs and overhauls. All-in costs dependent on depreciation, interest on capital, and other factors could not usefully be standardised.

He agreed with Mr. Buckton that the alteration in the position of the entrance to Madras Harbour and the construcion of the sheltering arm on the east side of it had removed for the present, and probably for a very considerable time,* anxiety in respect of siltation. Prior to that alteration, dredging had been essential, and without it, to quote Sir Francis Spring, "it might conceivably have had to be closed in heavy weather to vessels of deep draught, before the new entrance could be opened."** Mr. Buckton had emphasised what he had said about the inevitable effect of constructing artificial harbour works. His statement that "the engineer ought to work with nature as far as possible" constituted the fundamental principle of harbour work, and should be in the mind of every harbour engineer.

Whilst agreeing with Mr. Chalmers that sand pump and drag suction dredgers would no doubt deal economically with the silt at Newport and probably also at Cardiff, he was doubtful whether corresponding economy would result from the use of that type of dredger at Port Talbot and Swansea. A main factor in the reduction of dredging costs in the South Wales ports had been interchangeability of the craft employed, and, although reduction in costs at one port might be made by the utilisation of a particular type of plant, the present reductions of costs consequent upon interchangeability would probably outweigh local economies.

In reply to Mr. Latham, the author had already referred to sluicing at Burry Port. His Company had not carried out any constructional works there, but the amount of siltation had been insufficient to affect the handling of traffic to any considerable extent. Conditions in the estuary were continually changing owing to shifting of sandbanks, and during the last 10 years special steps had been taken to protect the railway between Llanelly and Ferryside. Those changes, and the protective works necessitated by them, were in themselves of sufficient importance to justify the preparation of a special Paper dealing with them.

*See also Sir F. J. E. Spring, "Coastal Sand-Travel near Madras Harbour." Minutes of Proceedings Inst.C.E., vol. cxciv. (1912-13, Part IV.), p. 163.

**"The Remodelling and Equipment of Madras Harbour." *Ibid.*, vol. cxc. (1911-12, Part IV.), p. 96.

The Institute of Transport

The Dock and Harbour Premiums, 1937.

The Institute of Transport is prepared to receive at 15, Savoy Street, W.C.2, not later than 31st May next, contributions submitted in competition for the two undermentioned Premiums donated by the Dock and Harbour Authorities Association. The Premiums take the form of:—

A Gold Medal for award to the author of the paper on a docks, harbour or conservancy subject, adjudged first in order of merit of those submitted for consideration.

A Silver Medal for award to the writer of the essay on a dock, harbour or conservancy subject, adjudged first in order of merit of those submitted for consideration.

The right is reserved to withhold the award of either or both medals if none of the contributions submitted attains a sufficient standard of excellence.

The writer of any contribution submitted for the Gold Medal must be a member of the Institute or a member or principal officer of an Authority affiliated to the Dock and Harbour Authorities Association. The writer of any contribution submitted for the Silver Medal must be a member of the Institute or of the staff (not being a principal officer) of an Authority affiliated to the Dock and Harbour Authorities Association. Contributions should, if possible, be typewritten on one side of foolscap paper and be submitted in duplicate. They must not exceed 10,000 words, exclusive of tables, for the Gold Medal, and 5,000 words, exclusive of tables, for the Silver Medal. They must be delivered to the Institute not later than May 31st, 1937, and must bear a suitable title. The author must, on a separate sheet, state his full name and address, designation, the undertaking with which he is engaged, the title of his contribution, and whether it is submitted in competition for the Gold or the Silver Medal. The author's name should not appear on the typescript of his contribution.

Contributions which comply with the conditions and are presented at meetings of the Institute (including meetings of Local Sections and Graduate and Student Societies) will, at the request of the author, be accepted for consideration.

A contribution which is not awarded a medal in any one year may, provided it is of sufficient merit, receive consideration the following year.

All contributions submitted will become the property of the Institute which reserves the right to publish any of them. An author awarded the Gold Medal may be required to submit his contribution for discussion at a meeting of the Institute, if not already so submitted.

References to books, pamphlets or articles, etc., must be accompanied by explicit particulars thereof to facilitate ready reference; any extracts from other works must be shown by quotation marks and their sources indicated. A bibliography should be appended.

The decision of the Council of the Institute will be final and binding and will be announced not later than October 31st, 1937.

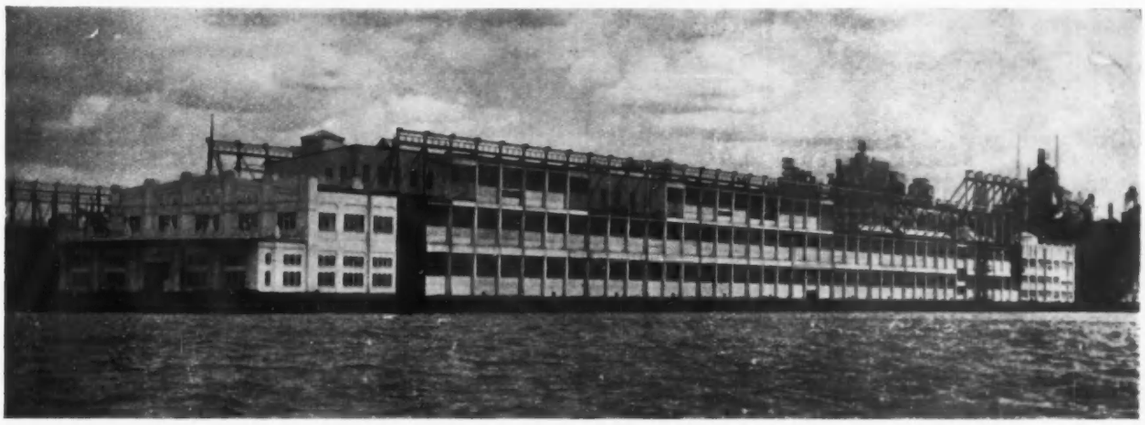
Southampton Docks.

Southampton will be a port of call for a new temporary service to be operated by the Compagnie Generale Transatlantique (French Line) to New York and Boston via Cobh. The inaugural call will be made by the liner "De Grasse," 18,000 tons, on the 29th May next, when passengers will be embarked at the port. Subsequent calls will be made at monthly intervals until September 17th and in each instance the port will be used for passenger embarkation purposes on the west bound voyage.

In addition to the records established at the docks in 1936 for the volume of shipping tonnage entering and the number of passengers dealt with the year was also notable for a substantial advance in the cargo traffic handled. The combined total of imports and exports amounted to 1,130,000 tons and was the highest registered since the pre-depression year of 1929. Comparison with 1935 figures showed an improvement of 8 per cent. in the volume of freight, both imports and exports being higher.

One of the most pleasing features of the import traffic was the continued development of timber shipments. Steady growth has characterised this trade throughout the post-war period and the figures for 1936 were of record proportions.

Large consignments of South African deciduous fruits are now reaching Southampton regularly each week by the mail steamers of the Union Castle Mail Steamship Company and the dimensions of these consignments may be gauged from the fact that the shipment landed from the "Stirling Castle" which arrived at the docks on the 12th February was 191,000 packages. As the season progresses the quantities brought over by the ships continue to increase until the "peak" is reached, generally in March. Last year seasonal imports of this produce through Southampton totalled 4,300,000 packages of apples, plums, pears, grapes, apricots and other varieties of choice fruit.



Pier No. 90, Hudson River, New York. Berth of S.S. "Queen Mary."

Maritime Passenger Stations

By BRYSSON CUNNINGHAM, D.Sc., B.E., F.R.S.E., M.Inst.C.E.

(A Lecture delivered before the Institute of Transport on December 8th, 1936)

THE subject of passenger traffic at ports has within recent years acquired a certain degree of prominence. The popularity of pleasure cruises on ocean-going liners and the revival of overseas travel generally has led to a marked increase in the arrivals and departures of passenger-carrying vessels and in the number of passengers passing through ports. It is true that the acute financial depression of 1931 caused an appreciable reduction in numbers as compared with the immediately preceding period and that the deficit has not yet been overtaken, but none the less, since 1931, in this country at any rate, there has been, as will be seen from Table I in the Appendix, a steady and gratifying increase in passenger traffic at ports. The Board of Trade returns show an annual total at the present time of about four million passengers of all classes and nationalities, landed or embarked at ports of the United Kingdom. Compared with the legions of travellers by rail or road, the number may perhaps appear insignificant, but, nevertheless, it represents a substantial volume of traffic, which as regards certain of our English ports constitutes a factor of considerable importance in their welfare.

Pleasure Cruising

The great wave of emigration to the colonies which prevailed in the latter half of last century, reaching its peak in the "eighties" but extending right up to the eve of the European War, has subsided to the moderate figure of about 30,000 in 1934 and in 1935, and is now succeeded by the wave of pleasure cruising. Fostered in 1925 by the creation of a special class of accommodation on ocean liners, designated "third class tourist," subsequently shortened to "tourist," the number of passengers under that head began at about 3,000. In the following year it rose to 37,000; in 1927 to 78,000; in 1928 to more than 91,000, passing the 100,000 mark in 1929. With subsequent fluctuations under the economic depression, the present level is perhaps about 130,000. Of course, persons travelling for pleasure are by no means confined to this class, or indeed to any class, but the growth of the "tourist" class affords some indication of the popularity of overseas travel as a means of recreation. In the statistics published by the Board

Customs Luggage Inspection, New York.

*Reproduced by permission from the Journal of the Institute.

Maritime Passenger Stations—continued

Disembarkation of Passengers at Ocean Dock, Southampton.

of Trade it is impracticable to separate business travel from pleasure travel; the only figure available in the returns is a joint total from which it is to be gathered that the number of British subjects who may be regarded as sea-travelling for business or pleasure during the past year or two has been of the order of 300,000, out and in, annually. This total includes persons travelling on pleasure cruises to places out of Europe: they numbered some 88,000 in 1934 and 72,000 in 1935.

British Passenger Ports

As regards overseas passenger traffic (i.e., travel, apart from pleasure cruises, to places out of Europe) the leading ports of the United Kingdom, in order of importance, are Southampton, London, Liverpool and Glasgow. Among these, as will be seen from Table II in the Appendix, Southampton is clearly pre-eminent. It is interesting to observe the change which has taken place in the relative position of the ports during the past ten or twelve years. Twelve years ago Southampton and Liverpool had approximately equal shares, dividing two-thirds of the whole traffic between them. Last year the number of passengers using Southampton as their port of embarkation or arrival was more than twice as great as the number commencing or terminating their voyages at Liverpool. London, after a temporary set-back, has steadily progressed so as now to have secured the second place. Glasgow has remained throughout fourth in rank, with a percentage of about 9 to 10 or rather less. Plymouth has had a percentage of between 10 and 14 of the inward traffic; the outward traffic in 1935 was almost negligible. The recent decline in the relative status of Liverpool is due in part to the practical cessation of emigration to North America; similarly in 1929 there was a drop in the London percentage due to the diminution of emigrant traffic to Australia.

Meanwhile the Port of Southampton continues to make remarkable headway in overseas passenger traffic. Taking the whole of the embarkations and arrivals, to and from all parts of the world, the port's aggregate for the year 1935 was 537,355, as compared with 484,074 in the previous year. The 1930 peak year record just before the financial slump, was 544,446. A fresh record seems likely for 1936. On August 22nd last, the day's work was the handling of 13 liners and 11 cross-channel steamers; more than 12,000 passengers passed through the port on that date.

Continental Traffic

In purely continental traffic, Dover, as the nearest port to the continent, naturally takes the lead. The total numbers of passengers during the past 12 years to and from continental Europe, including pleasure cruises to the Mediterranean, are given in Table III in the Appendix, from which it will be seen that falling by two-thirds in volume just after 1930, the traffic is now steadily regaining the three million mark which it touched in that year. Dover's share of the total is about three quarters of a million, followed by Folkestone, Harwich and Southampton, all fairly close together but some way behind Dover. The five English channel ports (Dover, Folkestone, Southampton, Newhaven and Weymouth) accounted for two-thirds of the entire passenger movement to and from the continent in 1935 and nearly 28 per cent. travelled via Dover. Outside the Channel ports, Harwich is easily the most favoured port of arrival and departure, with over 300,000 passengers per annum. On account of the development of traffic at the port, the London and North Eastern Railway Company have constructed within the last two or three years a quay extension of 1,200 ft. to accommodate three additional vessels. The quay and shed with improved facilities for passenger traffic is assigned to the Flushing service. Liverpool is noteworthy for its remarkable coastwise traffic which averages considerably over a million passengers per annum. For the last two years at the Princes Landing Stage, the figures have been 1,104,462 (1934) and 1,128,811 (1935).

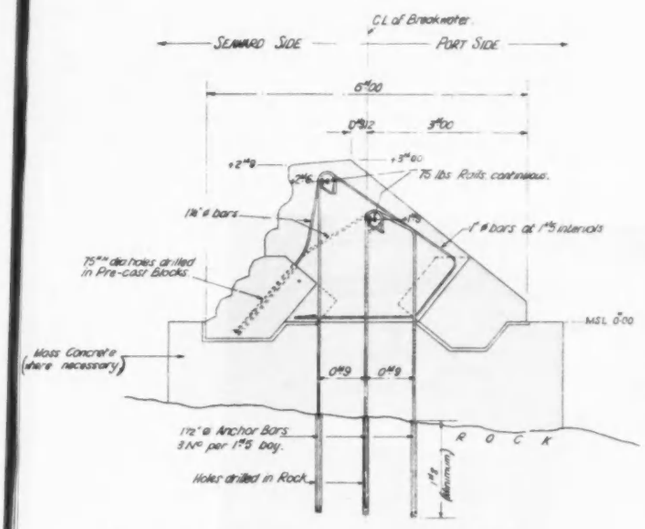
Modern Maritime Stations

Passing from this preliminary survey to the more immediate purview of the lecture, we will proceed to consider the rising standard of convenience and comfort provided for passengers on landing or embarkation and the modern developments in accommodation at ports, as exemplified by several recently installed stations on the continent of Europe, contrasting these with the less commodious and rather primitive arrangemen s which have hitherto been made to suffice elsewhere.

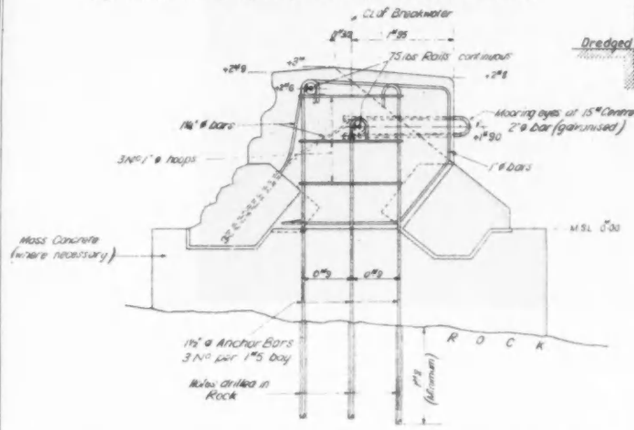
Until quite recently, a cargo shed, or a shed primarily designed for cargo handling and storage, has almost universally been considered a fit and proper place for the embarkation and landing of passengers. At a number of ports this view still holds. The passengers on landing are shepherded in an indis-

PORT IMPROVEMENTS AT J

CONSULTING ENGINEERS:– MESSRS RENDEL

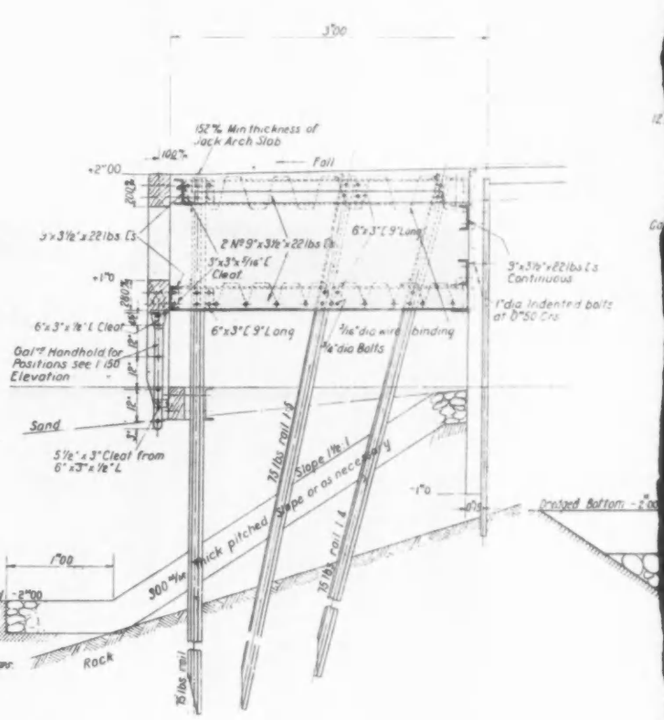


SECTION OF BREAKWATER AT NORMAL CREST.


C.L of Breakwater
75 lbs Rails continuous
Mooring eyes at 15" Centres. 2"ø bar (galvanised)
1"ø bars
MSL 0·00
Mass Concrete (where necessary)
1½"ø Anchor Bars 3 No per 1'5 bay
Holes drilled in Rock
ROCK

SECTION OF BREAKWATER AT MOORING RING BUTTRESS.

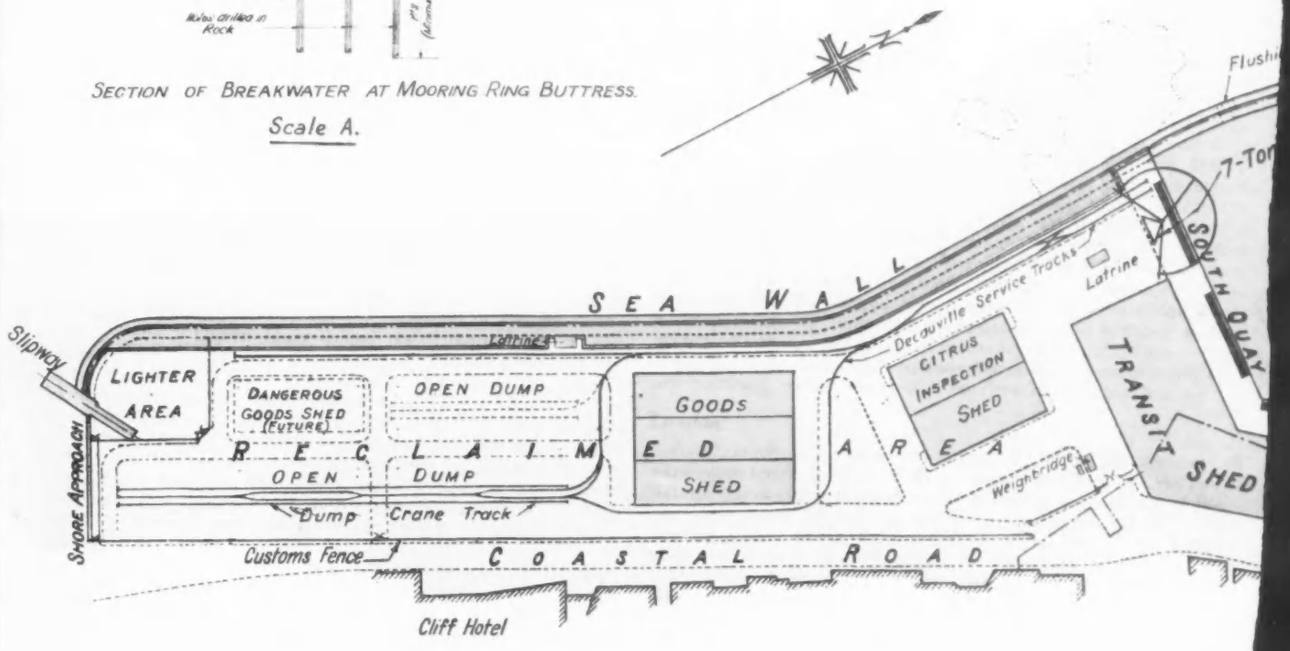
Scale A.



CROSS SECTION OF HIGH LEVEL QUAY

Wall as on Piled Foundation.

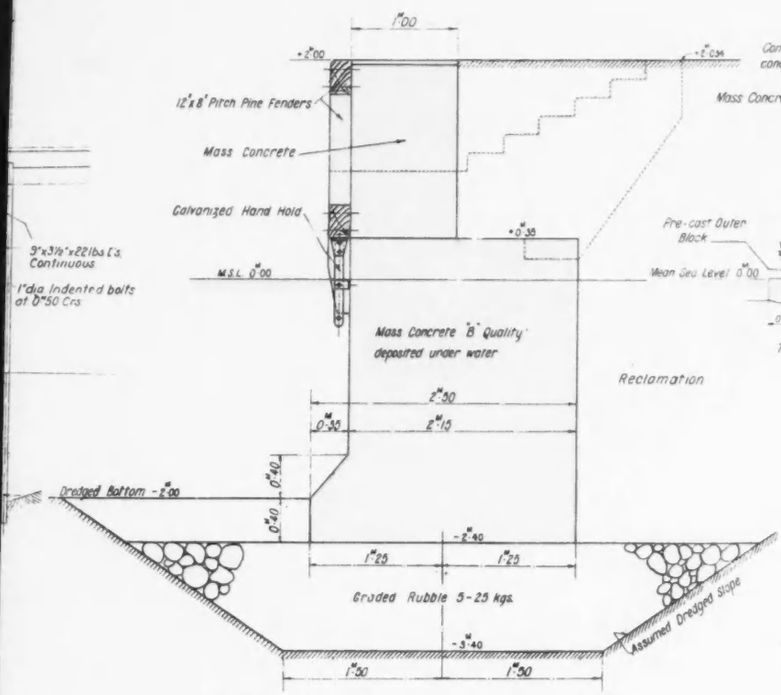
Scale B.



WARD & FOXLOW, LITH

AT JAFFA - PALEST

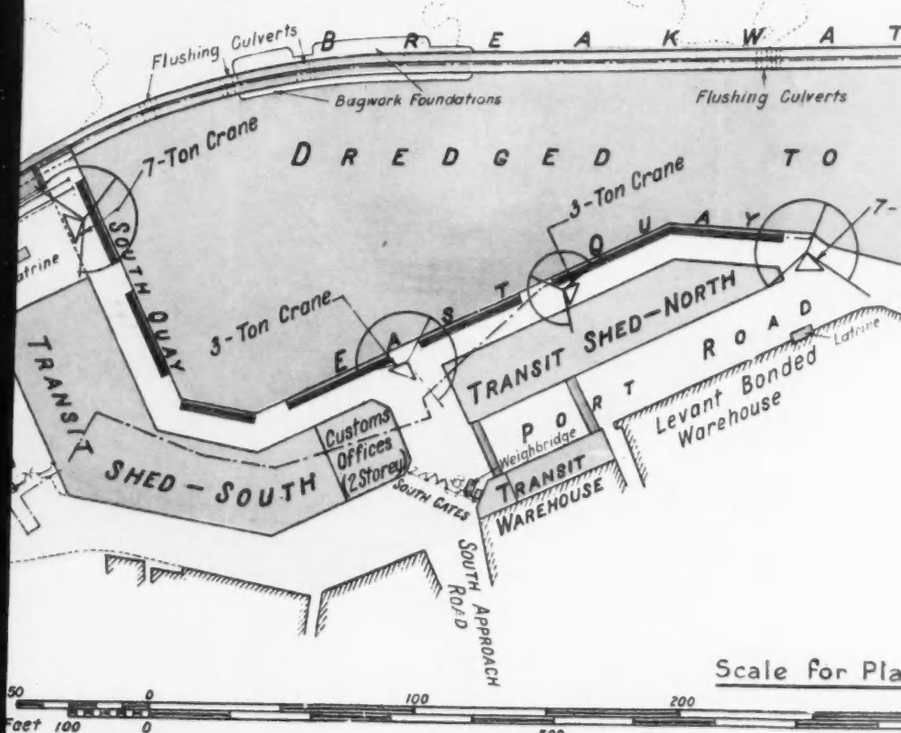
Messrs. RENDEL, PALMER & TRITTON.



CROSS SECTION OF HIGH LEVEL QUAY

Wall shown as an Rubble Foundation

Scale B.



WARD & FOXLOW, LITH., HARCOURT STREET, MARYLEBONE, W.

H. 1937.

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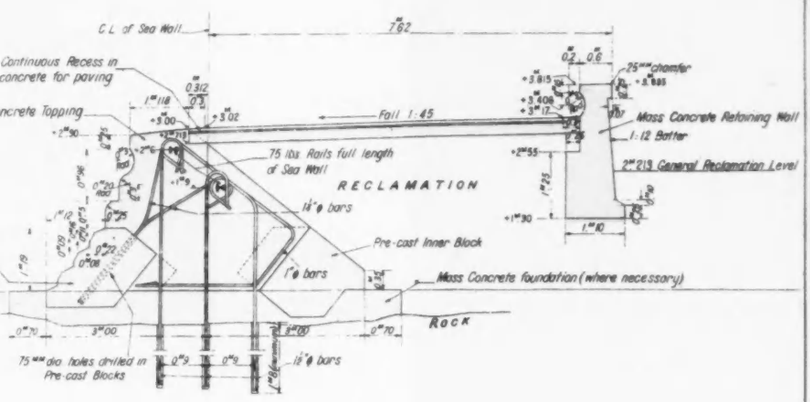


CROSS SECTION OF SEA WALL

Scale A.

Scale A.

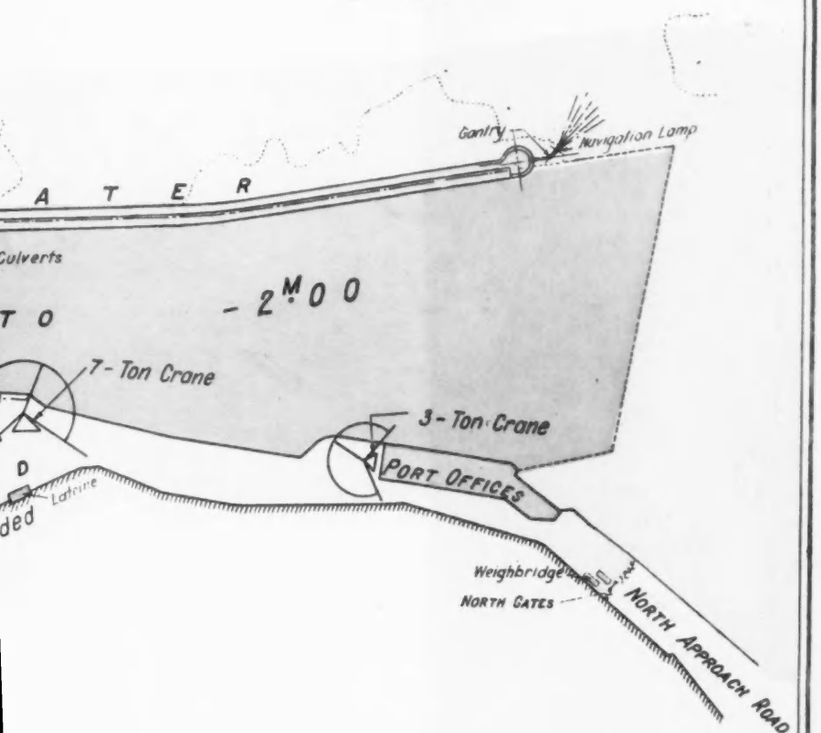
Metres 10 5 0 1 2 3 4 5 6 7 8 9 10 Metres

Feet 10 5 0 10 20 30 Feet

Metres 10 5 0 1 2 3 4 5 Metres

Feet 10 5 0 10 Feet

Scale B.



for Plan.

300 400 500 Metres

1,000 1,500 Feet

Maritime Passenger Stations—continued

criminate crowd of hustling humanity into a fenced or partitioned enclosure in a mere or less spacious goods shed, where they have to trace and claim their belongings, aided to some slight extent by alphabetical allocation, but finding various packages widely separted and mixed with, if not completely covered by, the property of others; then to seize or induce a porter to lift the heavy baggage on to the Customs tables, then to attract the elusive notice of a busy Customs officer, persuade him, after searching inquiry and perhaps elaborate investigation, to pass their baggage and then find another porter to convey it to the train: all of which is a troublesome and fatiguing process calculated to disturb the serenity of the most equably tempered individual. In addition, it is often necessary to stand in a queue in order to purchase railway tickets at a little box office and perhaps to search in vain for a disengaged telephone box to get a hasty message through before the train starts.

Let us take a glance at the Port of New York.

veyance. There is no direct railway connection with the piers: passengers proceeding to the interior of the continent must make their way as best they can to the Pennsylvania or Great Central Stations, which are some distance away.

On this side of the Atlantic, things are somewhat better.

Southampton.

At Southampton, vessels berth either in the Ocean Dock or at the New Dock Extension Quays of the River Test. In either case, passengers are received into single-storey sheds used also for cargo. At the Ocean Dock, dating from 1912, the sheds, which are 600 ft. long and 120 ft. wide in two roof spans of 60 ft., are constructed of steel framing with corrugated steel sheeting. A roof-level balcony runs along the quay front of the sheds, on to which passengers disembark from the upper deck of the vessel and proceed to shed floor level by means of internal stairways. On the landward side of the shed is an internal railway track with platform where

Interior of Lounge at New Sheds, Southampton Docks Extension
(Buffet Restaurant in rear).

Hudson River Piers, Manhattan.

The Chelsea Piers (Nos. 53 to 62) are a group of piers, or jetties, on the East bank of the Hudson River at Manhattan, New York, flanking Eleventh Avenue, which have constituted for a number of years past the chief landing places for transatlantic liners. They range in length between 800 and 900 ft. and have a width of 125 ft. The type of construction is the same in all cases: an open timber pile substructure with concrete decking, surmounted by a transit shed of corrugated iron on steel framing. The sheds are double-storeyed and are equipped with electric elevators, baggage escalators, and cargo hoists and winches.

Three additional piers of the same type have recently been constructed further upstream for the reception of vessels of the calibre of the "Queen Mary" and the "Normandie." The new piers are of the same width as the Chelsea piers, with a length of 1,100 ft. The sheds have a balcony at the inshore end and a promenade at the outer extremity. They are two storeys in height, with the exception of certain sections extending to three storeys located to correspond with the upper decks of ships, so that the use of steep gangways for passengers may be avoided. In each shed there are five passenger elevators connecting the several floors, an escalator capable of dealing with 8,000 persons per hour, and four freight elevators, besides baggage conveyors.

Internally, the strictly commercial aspect is scarcely inviting, the sheds being used for cargo and partly occupied by goods. There are no decorative effects and, in the older sheds, little, if anything, in the way of comfort or convenience. At the new sheds "well-appointed lounges and waiting rooms" are provided. After the luxurious fittings on board ship, passengers experience an abrupt change. They pass through in serried files to the baggage examination section, whence after satisfying the Customs officials, they are at liberty to depart into a busy waterside thoroughfare often congested with goods in transit, where they can engage taxis and other means of conpassengers entrain for London. There is lavatory accommodation, but no waiting room. Postal and telegraph facilities are available upon the occasions of the arrival or departure of passenger vessels. The restaurant is in an adjacent building. Railway tickets are obtained at a little temporary box office.

At the River Test Quay the sheds are larger, being 900 ft. by 150 ft., but, while the general arrangement of the structure is the same, with the substitution of brick panelling for the walls, the Southern Railway Company have provided certain additional amenities which have rendered the environment more agreeable, viz., a tastefully decorated and furnished lounge, with a buffet, in connection with each berth. Passengers, however, are still discharged into a bare steel-framed cargo shed, without means of temperature regulation, and without seating accommodation other than rudimentary wooden forms. Their baggage is examined on low movable wooden benches and they are confined within temporary barriers of wooden fencing.

London.

At London (as also at Liverpool) a certain amount of passenger traffic is dealt with in transit sheds at the dockside, but special accommodation is also provided in the form of floating stages, on account of the tidal conditions. The London landing stage, which was opened in May, 1930, is at Tilbury, and comprises a floating stage consisting of a wooden deck, 1,142 ft. long and 80 ft. wide, carried on 63 steel pontoons moored to the river bank by steel booms and mooring cables. The Customs baggage hall, built of brick on the river bank, with barrel plaster ceiling, is 295 ft. long by 72 ft. wide and 38 ft. high. Architecturally, the building has pleasing features and the interior presents a more appropriately finished appearance than the Southampton sheds, but the naked brickwork is austere and frigid, and the baggage is examined on transportable benches of inelaborate construction. Here, too, such seating as is provided is of a rather uncomfortable village-school type. The railway station of the L.M.S. Railway Com-

Maritime Passenger Stations—continued

pany adjoins the baggage hall and provides the usual waiting-room accommodation and other facilities. Exclusive of coastwise traffic, the figures for which are not available, the passenger movement at London during 1935 was 262,724.

Liverpool.

The Liverpool landing stage, with a total length of 2,534 ft. and a width of 80 ft., is a similar structure reconstructed after a fire in 1874 and sibdivided into three sections, of which the northernmost, called the Princes Stage, is allocated for sea-going vessels, tenders and tugs. Passengers disembark by means of high level movable gangways connected with a sheltered upper deck on the stage which, in turn, communicates with two Customs examination rooms, while beyond is the riverside railway station. Waiting rooms are provided, and a sheltered upper deck runs almost the entire length of the stage. Mechanical conveyors facilitate the transfer of luggage from ship to land conveyance. For the use of coastwise passengers there is a waiting room, with booking offices, telephone boxes, etc., at the north end of the Princes Parade.

The total volume of passenger traffic at the Princes Landing Stage in 1935 was 1,233,299. This includes coastwise traffic, but not landings and embarkations at the docks.

Having given these particulars of the leading passenger landing places in England, we will proceed to consider some continental examples.

Customs Baggage Examination Hall, Tilbury.

The Ponte dei Mille, Genoa.

Let us start with the palatial and architecturally ornate Stazione Marittima at the Port of Genoa. Genoa is one of the most progressive of Italian seaports, foremost in that country for the export and import of merchandise, but ranking below Trieste and Naples in the scale of passenger traffic. The number of passengers in and out annually is about 150,000. During the past ten or twelve years enormous strides have been made in port development. The harbour has completely outgrown its original natural enclosure, and now extends under cover of a magnificent breakwater for a distance of over three miles along the coastal frontage of the Ligurian Gulf.

The Stazione Marittima is an imposing structure, founded on a pier of open pilework, designated the Ponte dei Mille, and consisting of a triple block of buildings, three storeys in height, constructed of reinforced concrete with brick panelling and stone facings. The upper floors are in intercommunication by means of connecting passages, and there is a frontal esplanade, 160 ft. by 164 ft., at first-floor level.

As a general arrangement it has been contemplated that vessels on their arrival will berth at the western side of the pier and depart from the eastern side. The order, however, can be reversed if found desirable. Furthermore, the whole of the services for third-class passengers are arranged at the quay level, leaving the first upper floor, with its more esthetic treatment, at the disposal of the first and second-class passengers.

The maritime station is approached from the city by an overhead viaduct, 300 ft. long by 75 ft. wide, which, rising at a slight gradient, leaves the main thoroughfare and public square alongside the railway terminus (Stazione Principe) at a height of about 30 ft. above the quay level of the Pente dei Mille, and leads to the elevated esplanade. This arrangement has been adopted in order to meet the needs of the railway services, which are distributed between the upper and lower levels and, specially, in order to avoid the necessity of passengers traversing the numerous rail tracks at quay level. The viaduct is carried on four arches with beams of reinforced concrete, supported on columns in couples, having an interaxial distance of about 50 ft., so as to allow the passage between them of a passenger service train running on a track laid the full length of the viaduct and the pier, as far as its extremity. The architectural treatment of the station exterior is distinctly impressive.

The main entrance of the Maritime Station from the esplanade leads into a public concourse hall, octagonal in form, surmounted by a cupola of reinforced concrete carried on eight columns. The hall has an internal diameter of 65 ft. and a height of about 60 ft. from floor to roof light. It is ornamented with artificial stonework, the panelling and column bases being of Trani stone, and the floor laid in mosaic. From the concourse hall there is a convenient access to the post office and to telephone boxes, the money-changing bureau, and the florist's, tobacconist's and newspaper stalls. Approached through corridors, the waiting rooms, writing rooms, restaurant, passport examination room and steamship companies' offices are in close contiguity to a central gallery, which is the core of the station, whence there is communication with the Customs examination hall, the registration and despatch offices for luggage and the embarkation and landing galleries.

On arrival from sea, the passengers disembark normally by means of the movable gangways on the terrace at the west side of the station, traverse the landing gallery and arrive at the Customs examination hall, a spacious compartment, 164 ft. long by 36 ft. wide, roof lighted, with a central double row of fixed benching carried on stout ornamental pedestals. The chamber is made pleasing and attractive by its internal decoration of stucco work, with panels in colour of various design giving panoramic views of the country of a nature to appeal to the tourist. After examination, baggage can be consigned from an adjoining office, whence the pieces are withdrawn by the railway staff and lowered to the despatch room or safe on the ground floor, or alternatively, they can accompany the passenger who, leaving the hall, passes through the arcades, to find, drawn on the esplanade outside, automobiles, taxis and the hotel autobuses.

The embarking passenger, on reaching the eastern side of the esplanade, hands over his baggage for registration and proceeds to board his ship. Hand luggage accompanies him while the larger pieces are loaded on to trolleys which are lowered to quay level by means of inclined moving conveyors, and thence drawn to the loading hatches of the vessel.

Maritime Passenger Stations

General View of Harbour and Maritime Station, Ponte dei Mille, Genoa.

Customs Baggage Examination Hall, Ponte dei Mille, Genoa.

Maritime Passenger Stations—continued

It is interesting to note that the station is provided with a duplicate hot-water pressure heating system, and that the sanitary system and water supply are independent units. The lighting system is general throughout, furnished with an auxiliary for the main public centres.

The total cost of the Maritime Station at the Ponte dei Mille, which in its entirety covers an area of 20,000 sq. yds., was 18 million lire, equivalent roughly to £200,000 at par of exchange. Since its completion in 1930, it has been found necessary to make an extension incorporating the adjoining pier, the Ponte Andrea Doria, which has been connected to the Ponte dei Mille by a continuation of the high-level viaduct.

The works were carried out under the direction of Commendatore Ariberto Albertazzi, engineer-in-chief and director of the port, to whose courteous explanations and guidance during my visits to the port while operations were in progress and also after completion, I am indebted for my information, as also to his kindness in supplying the photographs from which blocks have been made.

The Jetty and Maritime Station at Le Verdon, Bordeaux
(S.S. "Champlain" alongside).

Naples.

On October 1st last, a similarly imposing new maritime passenger station was inaugurated on the Molo Luigi Razza at Naples, consisting of a rectangular block of buildings, about 570 ft. by 275 ft., comprising two wings, each 570 ft. long by 90 ft. wide, with an intermediate space for rail tracks, the upper floors of the wings being connected by central and end decks. Mr. Godfrey Fisher, H.B.M. Consul-General at Naples, has been so good as to obtain for me plans of the two floors, from which it can be seen that the lower floor at quay level is reserved for rail, postal and emigration services, while the upper floor is assigned to the reception of passengers. Unfortunately, no views of the interior are available—there is reason to believe that the building is still in an incomplete state—but the external view gives a general impression of dignity, and the plans show commodious accommodation. The new station is in a central position, fronting on to the Piazza Municipio, one of the principle squares near the hotel and shopping districts. The annual passenger movement at the Port of Naples is in the neighbourhood of a million, mainly third class, there being an important emigration movement.

Le Verdon, outport of Bordeaux.

In contrast to the situation of the Genoese and Neapolitan maritime stations, which are in close proximity to the commercial and shipping centres of the ports, the Gare Maritime at Le Verdon is located at a distance of 100 kilometres (62 miles) by water from the main Port of Bordeaux to which it is an adjunct. Until recently, passenger vessels had to traverse the length of the Gironde Estuary and part of the River Garonne before reaching a convenient landing place. The river is tidal, and on suitable flood tides it is possible for vessels drawing 28 to 29½ ft. to reach the port, but there is considerable loss of time in making the journey by water—amounting to several hours—a loss which could not be tolerated by business men anxious to reach Paris and the European capitals as speedily as possible. Even the limited depth in question is only maintainable by constant dredging in the navigable channel, resulting in the removal of some two million cubic yards of material per annum. From the time of its creation in 1925, the Autonomous Port Authority of Bordeaux has had the problem under consideration, and every credit is due to Monsieur François Lévêque, the director and engineer-in-chief, with his colleagues and assistants, for the courageous way in which the difficulties have been faced and congratulations have been received by them on the strikingly successful outcome of their labours.

It was decided in 1928 to construct a jetty, or pier, at the mouth of the estuary in a sheltered position with convenient access from the sea through a new channel dredged through the bar called the Great West Channel, with a minimum depth of 31 ft., and, for the greater part, with a depth of 33 ft. The jetty itself has been constructed in depths which afford berthage at low water on the inside and outside faces, for vessels drawing 40 and 46 ft. respectively. The design of the structure presents many interesting engineering features which cannot appropriately be discussed here, though it may be mentioned that each of the reinforced concrete columnar piers, 87 ft. long and 13 ft. diameter above the base, weighs 290 tons. The shells of the piers were moulded on shore, launched, and upended in position, after which they were sunk to the requisite foundation depth by an ingenious process of internal sand suction within a period of a few hours and thereafter filled with concrete.

The balancing fenders of azobé timber are spaced 100 ft. apart. They are 30 ft. high, 4 ft. wide and weigh 32 tons each. Four fenders are designed to take up the way of a 60,000-ton vessel approaching the structure perpendicularly at a speed of 1 ft. per second.

The jetty, which has a utilisable length of 1,040 ft. and a deck width of 124½ ft., comprises two stages or floors. The lower is assigned to the railway service and the maintenance department. Accordingly it has 4 lines of track, of which the outer lines are for goods, baggage, and postal services, while the central pair are reserved for passenger traffic. On the upper floor is the main structure of the Maritime Station, 446 ft. long and 72 ft. wide, containing all the accessories and facilities for handling passenger traffic, the chief features being the main concourse hall, 140 ft. by 38 ft., with access to a post and telegraph office, telephone boxes, money-changing bureau, tourist office and sanitary conveniences connected therewith. At one end is a commodious waiting room (containing a bar, with "cuisine") for first and second-class passengers, 63 ft. by 38 ft., with a writing room adjacent, and at the other end the Customs baggage examination hall with practically the same dimensions as the great hall. In the centre of the latter is the Customs office with a double line of solid benching running longitudinally therefrom. These benchings are of reinforced concrete, surfaced like the floor in mosaic. The baggage examination hall is flanked on each side by landing galleries and on one side by a carriage-way connecting the two courts at each end of the station. The courts, or yards for vehicular parking, are linked with the main road to Bordeaux by a carriage-way 18 ft. wide carried clear of the rail tracks which pass underneath. It is possible by automobile to traverse the 56 miles of modernised roadway, constructed with non-skid surfacing, to Bordeaux within an hour and a quarter. The railway follows a longer route of 70 miles through Pauillac, but the electric service performs the run in 1 hour and 10 minutes. From Bordeaux the whole network of lines to continental Europe is available, and there are fast trains to Paris, Lyons, Marseilles and beyond, without change.

Maritime Passenger Stations

Front View of Maritime Station, Cherbourg.

General View of Tidal Basin with Maritime Station of Compagnie Generale Transatlantique, Le Havre (S.S. "Normandie" in foreground).

Maritime Passenger Stations—continued

This magnificent enterprise of the Gare Maritime of Le Verdon and its approach channel from the sea was completed in 1933 after four years of intense engineering activity at a cost for the station proper of about 195 million francs, say rather more than a million and a half sterling at par of exchange. The passenger movement at the Port of Bordeaux is of the order of 70,000 per annum (70,360 in 1935).

Cherbourg.

The opening on July 29th, 1933, by the President of the French Republic of the new quay and Maritime Station at Cherbourg for transatlantic passenger traffic was an event of outstanding importance in the history of the port. Owing to a curious combination of circumstances, Cherbourg fulfils a dual role. Quite apart from its passenger traffic and commercial activities it is essentially a great naval base. It possesses a magnificent artificial outer harbour or roadstead of 3,600 acres which was specially designed for military and naval purposes as far back as the close of the 18th century. To-day, the port has come to be used in ever increasing numbers by transatlantic liners which make Cherbourg their port of call for passengers to and from the continent of Europe. Prior to the European war, and thereafter between 1920 and 1930, there was a steady and fairly rapid increase in this traffic as is evidenced by the following table:—

Year	No. of liners calling	Aggregate tonnage	No. of passengers embarking and disembarking
1880	84	178,746	2,295
1900	378	1,651,884	30,313
1913	555	4,503,653	68,678
1925	876	21,517,006	172,641
1930	946	25,529,264	183,786

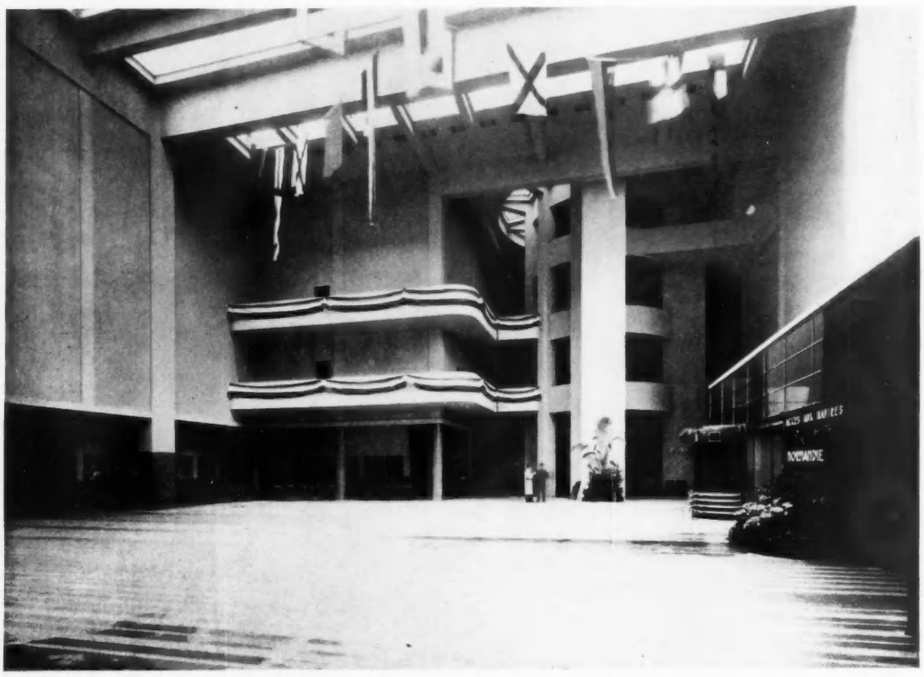
The financial slump of 1931 brought about a serious set-back and the number of passengers in 1935 had fallen to 76,108. Still, notwithstanding this set-back, the Chamber of Commerce fo the port, encouraged by its President, Monsieur C. T. Quoniam, with a confident hope of a recovery in prosperity continued its efforts for the completion of an installation for passenger traffic which had been actually begun in 1923, but subsequently underwent important modification.

Until recently, the process of embarkation and disembarkation was accomplished by a service of tenders passing between the vessels lying at anchor in the Great Roadstead and an inner quay of the port. But this method became increasingly inadequate and inconvenient. The new installation consists of a mole or jetty in a depth of water of 33-36 ft., with a frontage of just over 2,000 ft., forming the substructure for a maritime station which has a frontage of 1,640 lin. ft., of which 920 ft. represents the main block of buildings and the remainder a covered extension of the upper promenade gallery.

The main edifice is a double-storeyed structure 140 ft. wide, in the centre of which on the upper floor is the main concourse or waiting hall, flanked by pavilions at each side, forming portals of honour and surmounted by turrets containing water tanks. On one of the pavilions is erected, to a height of 220 ft., a campanile, or clock tower, which is a most striking architectural feature, visible at a distance of 15 miles out at sea.

On each side of the waiting hall are the two Customs examination halls and the accommodation allocated to various services, such as the offices of the shipping companies, telegraph, cable and telephone offices, exchange bureau, refreshment bar, shops and general facilities for passengers arriving and departing, with special accommodation for emigrants.

Below on the ground floor, parallel with the front structure, and reached from the main approach corridor by flights of stairways are (a) the railway station, a great hall, 787 ft. long by 118 ft. wide, with the arched ribs of its roof rising 66 ft. above rail level and possessing three platforms served by four lines of track; (b) the roadway, 50 ft. wide, for automobile and vehicular traffic; and (c) the sidings and service lines for heavy goods, baggage and mails.



Principal Waiting Hall (1st and 2nd class) at the Maritime Station of the Compagnie Generale Transatlantique, Le Havre.

The station building is supported on piles to the number of 923, about 65 ft. long, driven through light sand filling to the underlying rock stratum. The constructional work is of reinforced concrete, with brick panels and artificial stone dressings. The moulded stone is composed of crushed granite and gravel, treated after erection with the sand blast so as to bring out the natural appearance of the local granite, which has a light pinkish tint. The roof is in three spans and is covered with copper sheets which, oxidised by the saline air, give a striking green tint to the eye.

An interesting feature of the quay front is the set of nine movable bascule gangways, which serve for the transfer of passengers and their baggage from the deck of the vessel alongside the quay to the upper floor of the maritime station. These flexible structures have a length of about 100 ft. and an internal width of 12½ ft., divided longitudinally so as to give a passageway on foot alongside a moving belt for hand luggage. At each extremity of the belt is a short length of roller runway. Baggage is handled on the upper floor of the station by means of electric trucks. The quay is also served by a series of electric cranes, the largest of which has a capacity of 15 tons; four are of 5 tons capacity and two of 3 tons. They run on tracks on the quay front, the gangway being lifted to allow them passage.

The total cost of the maritime station amounted to 70 million francs (roughly £560,000 sterling at par of exchange). The entire scheme of quay development including the dredging of the approach channels runs to some 200 million francs.

Le Havre.

Le Havre is a port at which by reason of its important transatlantic services, maritime passenger accommodation has been developed considerably of late years both in extent and equipment. Two large new stations were officially opened by

Maritime Passenger Stations—continued

President Le Brun in May, 1935. There are now four quay-side stations: one at the Quay Joannès-Couvert operated by the Compagnie Générale Transatlantique, two at the Mole Oblique and the Florida Quay, respectively, forming part of a concession to the Compagnie Industrielle Maritime and the fourth at the Quai d'Escale belonging to the port authority. The most striking of the four, both in position and appearance, is the Gare Maritime of C.G.T. which receives the "Normandie" and other transatlantic liners. It is a three-storey building nearly 2,000 ft. long (600 metres) capable of serving two vessels simultaneously. Passenger traffic is dealt with on the first floor in a series of spacious compartments comprising a Customs examination hall, with post and telegraph office, waiting and refreshment rooms, bookstall, enquiry bureau and other facilities. There has been little attempt at decoration beyond a prevalent interior yellowish tone of colour-

Oblique Quay. The general arrangement of the interiors is the same, the upper floors providing waiting rooms of considerable amplitude, with ornamental veneered dados of polished wood and pleasingly furnished with upholstered arm-chairs, divans and tables arranged in groups. The rooms are warmer in winter. The Customs hall is included so that, in the words of the company, "the passenger supervises his baggage without having to disturb himself until the moment when his turn comes to present it for inspection." The other arrangements include offices for the shipping companies, lavatories, a bar, an emergency "cuisine" where in case of unforeseen delay in the arrival of a vessel a warm meal can be served, a library, a medical inspection room, telephone and telegraph offices and money-changing bureau. On the ground floor are additional waiting rooms for cabin and third-class passengers.

Waiting Hall of Port Authority's Maritime Station, Le Havre.

ing on the reinforced concrete walls and pillars; the architecture is severely simple in the modern style, and the building is impressive more by its proportions than by its esthetic treatment. The most prominent structural feature is a tower, 260 ft. in height, which not only commands from its summit a magnificent view of the town and port, but also serves as a magnified tide gauge visible for a considerable distance. The sea level is indicated by a pointer on a vertical scale, the figures of which are 10 ft. high. There is a clock at the top of the tower with a face 20 ft. in diameter. Automobiles and cars reach the level of the first floor of the building by means of an inclined ramp, a branch of which is continued to the level of the top floor. The ground floor and the third floor are utilised for goods.

Passengers for the railway line take the train in a capacious hall, to which access is afforded by moving stairs from the first floor level. The hall has a length of 1,050 ft., and there are four lines of track. The roof is arched in three articulations with a span of 92 ft. and has a covering of "translucent" concrete, the term applied to prisms of glass bedded in a concrete framework. The hall is closed at each end, in order to exclude draughts, by doors which are raised automatically on the approach of a train. There are other rail tracks at quay level to serve goods traffic.

The equipment of the maritime station includes two gangways for passengers, 10 baggage cranes of 1½ ton capacity, several 5 to 10 ton cranes, a baggage transporter and monorails.

The maritime stations of the Compagnie Industrielle Maritime (C.I.M.), which also accommodate transatlantic liners, are established on open framework substructures of reinforced concrete piling with a series of solid concrete dolphins, or "ducs d'Albe," spaced at 130 ft. intervals, forming a berthage front for shipping. The single length of the North Quay and the two sides of the Oblique Jetty or Mole Oblique, give an aggregate of four berths of 1,000 ft. (300 metres) each, viz., two at the North Quay and one on each side of the

Trains are dispatched from the interior of the building at quay level and, in order to obviate the discomfort of steam engines under cover, the service inside the building is performed by the C.I.M.'s own locomotive tractor of the Baudet Donon-Roussel type.

The port authority's station is on the Quai d'Escale of the outer harbour, and has a frontage of 500 metres (1,640 ft.). The general arrangement is as previously described, the waiting rooms, baggage examination rooms, refreshment rooms, etc., being arranged on the upper floor with the rail service below.

Hamburg.

Although not of recent date, it is desirable to include some reference to the well-known St. Pauli landing stage at Hamburg which was constructed in 1907-9. It is a floating structure, 1,400 ft. (420 metres) long and 66 ft. wide, consisting of a wooden decking carried on 109 floating iron caissons, connected to the bank by nine movable bridges, each of which is about 100 ft. span and about 29 ft. wide. The rearward portion of the stage contains waiting-room accommodation, luggage depots and shops. At the eastern end is an upper floor, 660 ft. long, where sea-going vessels can discharge their passengers at promenade deck level. On the river bank directly adjacent to the stage, an imposing main reception building constitutes the approach to the stage and contains a large cloak room, baggage dispatch room, officials' quarters, cash office (Kassenräume), booking offices and a restaurant. The flat roof of the building is utilised as a roof garden for the restaurant; at its eastern end is a lofty clock tower and tide gauge.

An important adjunct to the passenger traffic at Hamburg is the outlying Port of Cuxhaven, 64 miles distant on the outer Elbe Estuary. It serves the same purpose to Hamburg as Le Verdon to Bordeaux and Tilbury to London. Overseas passengers are landed at the Steubenhöft, which has a length of 1,300 ft. (400 metres) and a width of 72 ft.; they pass

Maritime Passenger Stations—continued

through a covered passage to the customs and waiting rooms in the station alongside.

Conclusion

From this necessarily brief and condensed survey of certain modern developments in maritime passenger station design, it is obvious that there are no less than five distinct points of view to be considered in arriving at a satisfactory arrangement for passenger traffic. These are the views of:

(1) The shipping company,
(2) The port authority,
(3) The Customs authority,
(4) The railway company, and lastly,
(5) The passenger himself.

It is not altogether an easy matter to reconcile them all, involving, as they do, problems of finance, of local commercial requirements and of technical difficulties at the site; but, ignoring individual complications, it is permissible to postulate certain general principles for consideration in connection with future installations, more particularly for overseas traffic:

1. That, wherever practicable, it is desirable to separate passenger traffic from goods traffic. The atmosphere and environment of a cargo shed are not in keeping with the standard of comfort and convenience to which travellers are accustomed on board ship, or in journeying by rail or car.

2. That where a quay has of necessity to be used for both classes of traffic, it is advisable to provide a double-storey structure, the upper floor of which can be assigned entirely to passenger traffic. Passengers should enter the upper portion of the building by means of high-level gangways, so as not to be compelled to traverse crane and wagon rail tracks, nor to pick their way across ships' moorings and between lines of rolling stock. The railway platforms for passenger traffic at the rear of the berth should be accessible by stairways direct from the upper floor.

3. That in seaports of importance, the standard of esthetic treatment for the interior of passenger stations should be at least equal to that of metropolitan railway terminals, with attractive architectural features, pleasing decorations, comfortable waiting rooms, restaurants, postal and telegraph offices, an ample number of telephone call boxes and all the usual station facilities and conveniences. In view of its generally exposed position, the station as a whole, or, at any rate the Customs hall and waiting rooms, should be warmed in the winter time. Invalids, the elderly, and young children need consideration no less than the robust and healthy.

4. With a view to reducing confusion in times of heavy pressure, arrangements should be devised for reinforcing the staff and securing an equitable distribution of porterage for the needs of passengers.

5. That the subject of Customs inspection should be carefully investigated so as to arrive at a procedure which will entail the minimum of inconvenience to the passenger.

The first three considerations are of a constructional nature, either engineering or architectural, or both. They have been demonstrated by the views which have been shown on the screen. The other two considerations belong to the department of organisation. Without going very closely into them, which would be impossible in the time available, it may be suggested that an efficient system of porterage requires the expert direction of supervisors to ensure that passengers are attended to with some degree of uniformity, and are not left to be the victims of haphazard assistance; while, as regards Customs inspection there are possibilities of examining baggage on board ship before disembarkation and on the train, while proceeding inland, which merit attention.

First impressions are of great importance. It cannot be too strongly emphasised that the psychological effect on a traveller of his reception in a new country is bound to influence his judgment on the country and its inhabitants and may act as a deterrent or as an incentive to further visits.

In addition to the names already mentioned in the course of the lecture, I am indebted to the Southern Railway Company, the Cunard White Star Company and the Port Authorities of London, Liverpool, Havre (including the concessionary companies), Cherbourg, Bordeaux and Hamburg for photographs and for information kindly supplied.

APPENDIX.

NOTE:—The tables in the Appendix have been compiled from returns published in "The Board of Trade Journal."

Table I.

Total numbers of passengers of all classes and all nationalities who landed and embarked at ports of the United Kingdom by sea or air (Numbers given in thousands):—

Passengers of all nationalities	Year						
	1929	1930	1931	1932	1933	1934	1935
To and from countries out of Europe ...	677	618	469	499	479	489	497
To and from European countries including Mediterranean and Black Sea ports ...	2,994	3,055	2,758	2,082	2,366	2,454	2,721
To and from Irish Free State ...	740	735	746	742	721	774	851
Totals ...	4,411	4,408	3,973	3,323	3,566	3,717	4,069

Table II.

Total numbers of passengers to and from places out of Europe who embarked or arrived at the principal passenger ports in the United Kingdom with the percentages of the totals for the three leading ports:—

Year	Total numbers of passengers out and in	Percentages of totals:		
		Southampton	Liverpool	London
1924	624,738	33	31	19
1925	596,112	33	31	19
1926	639,817	34	28	20
1927	673,880	33	28	19½
1928	673,952	34	28	18
1929	677,339	36	26	15
1930	618,361	35	25	15
1931	468,825	38	23	18
1932	424,753	35	23	20
1933	378,840	35	22	22
1934	401,044	37	21	22
1935	425,299	41	18	22

NOTE: The figures given in the above table are exclusive of the number of persons travelling on pleasure cruises between the United Kingdom and places out of Europe.

Table III.

Total numbers of passengers to and from Continental Europe, including those travelling on pleasure cruises to the Mediterranean, at ports and air stations of the United Kingdom:—

Year	*via* Ports	*via* Air Stations	Total
1924	2,301,314	17,858	2,322,172
1925	2,487,105	20,721	2,507,826
1926	2,551,214	25,524	2,576,738
1927	2,666,112	28,764	2,694,876
1928	2,927,027	43,500	2,970,527
1929	2,945,882	48,670	2,994,552
1930	3,011,799	43,049	3,054,848
1931	2,712,256	46,671	2,758,927
1932	2,010,080	71,649	2,081,729
1933	2,274,419	92,203	2,366,622
1934	2,328,563	125,328	2,453,891
1935	2,566,117	155,076	2,721,193

Glasgow Docks to be Extended.

The Clyde Trustees decided at their meeting recently to purchase Meadowside Shipyard, extending to over 12 acres, at a cost of £50,000, with a view to constructing new deep-water docks for the handling of cargoes in the port.

It was also agreed to negotiate for the purchase of an area of ground approximately one acre in extent fronting the river to the east of Meadowside and lying between it and the mouth of the river Kelvin.

The purchase of the ground in no way affects the dry dock and repair department at Meadowside which was disposed of last year to a new company formed under the name of D. and W. Henderson Ltd., and carried on as a subsidiary of Messrs. Harland and Wolff.

Mr. W. F. Robertson, chairman of the Trust, who moved the adoption of the minute recommending the acquisition of the ground, said the transaction would enable the Trust to improve and widen the river slightly at a narrow point, and would also make a popular part of the harbour available for up-to-date deep-water berths and shed accommodation.

Congratulating the Trust on the way in which they had taken advantage of their opportunity, Treasurer P. J. Dollan said that if the proposals were developed they would facilitate shipping on the river and provide additional employment in an area where men had been displaced.

Mackay Harbour Works

THE Mackay Harbour Board, Queensland, have decided to call for tenders for the completion of the breakwaters and the wharf, as well as the railway bridge over the Pioneer River. Plans and specifications are being prepared by Mr. D. Fison, supervising engineer. The road to the outer harbour and the railway bridge over Barnes Creek will be built by the Board.

Mr. G. A. Stronach, who took a contract for the construction of the harbour, at an estimated cost of £766,000, encountered many difficulties during the first 12 months of the works, but for several months prior to the cancellation of the contract he made excellent progress, both in quarrying the stone and also in the extension of the breakwater. His services have been retained by the board as works manager.

The tracks and rolling stock have been thoroughly overhauled and the quarry layout is now in an advanced state with some 28 well-drill boreholes down the full depth of quarry face ready for loading and firing. A 5-kv.a. three phase transformer made by Crompton Parkinson Ltd., Sydney, and supplied through their agents, Noyes Bros., has just been installed for firing purposes.

The works, as designed, consist of an enclosed harbour, about 140 acres in extent, protected by a southern and northern breakwater of rubble stone with a concrete capping. Wharfage accommodation will be provided along the southern breakwater, while future extensions, such as piers, will be constructed as required. The site selected is approximately two miles north of the mouth of the Pioneer river, and is connected by rail and road with the city of Mackay about 3½ miles distant. There is a natural depth of 30-ft. at low water spring tides at the entrance, which will be 600-ft. wide. The swinging basin is to be dredged to a depth of 24-ft. l.w.s.t. and the berths to 33-ft. l.w.s.t., which, at neap tides, represents 38-ft. 7-in. and 47-ft. 7-in. respectively at high water. At h.w.s.t. the depth at the berthage will be about 54-ft. and 45-ft. in the swimming basin.

The full length of the southern breakwater will be 4,350-ft., the northern breakwater 3,375-ft. and the height is given as 12-ft. above spring tides. The southern is now out 1,250-ft., and a start will be made shortly on the northern, the connecting transport line for which is complete for about 2,700-ft. The outer slope will be 1½ to 1, and inner slope 1 to 1. The inner portion of the southern breakwater—between the wharf and the root of the breakwater—will be sufficient width to take two double sets of railway lines, a 33-ft. roadway and a 5-ft. footway, protected from any spray by a parapet wall. Similar provision, but with a 30-ft. roadway, is also provided for behind the wharf. The width will be 98-ft. at the top and 190-ft. at the base. The other portion of the breakwater will have a width of 18-ft. at top and 160-ft. at base of the outer cants.

The wharf, 1,200-ft. by 100-ft. will be of reinforced concrete, the front of which will be served by two lines of rails flush-decked, suitable for rail or vehicular traffic. Provision is made for two sheds, roofed with asbestos cement sheets—one 420-ft. by 66-ft. for the storage of sugar, the other 210-ft. by 66-ft. for general cargo. A modern elevator will be installed for the handling of sugar and general cargo.

Communication with the city of Mackay will be by rail and road, running almost parallel. The scheme also includes a total length of new road 2 m. 45 ch., in addition to drainage structures, two double 5-ft. by 3-ft. reinforced culverts, one eight span bridge 250-ft. long over Vines creek, and one 28-ft. bridge over Bassett creek. These structures are A Class M.R.C. bridges, 20-ft. between kerbs on five timber piers, with bituminous deck wearing surfaces. There is also provision for a bridge across Pioneer river, to be of rolled steel girder superstructure, in spans of 30-ft., supported on timber piled piers to withstand heavy floods, the piles being protected from marine organisms by Muntz metal sheeting.

The stone for the breakwaters which is of the diorite variety (approximately 170 lb. per c. ft.) is obtained from Mount Bassett some 70 chains from the root of the southern breakwater. In exposed positions boulders of a maximum weight of seven tons are used in the superstructure, while the smaller stone, down to 20 lb., is used in the approach to the wharf, and in other sections below the influence of the sea.

The stone is excavated from the face of the quarry by the well-drill method of blasting. Three boring plants are now in operation; these drill 8-in. boreholes, the full depth of an 83-ft. face, the average face burden on each hole being 30-ft. at spacings of 40-ft. centres. The plant includes one Bucyrus Armstrong 33 h.p. prospecting drill, supplied by Ruston and Hornsby Ltd., Brisbane; the other two were made by the Toowoomba Foundry Co. Each plant runs at a fuel cost of 8d. per shift. A feature of the Bucyrus-Armstrong rig is the patented rubber shock absorber which, always working with approximately the same amount of compression and reaction, produces an even drilling action and protects the machinery against shock and jar.

The most modern blasting methods for obtaining stone of the size desired and in large quantities are employed. The explosives are loaded in columns instead of by the older method of "bulling" the bottom of each borehole and loading the whole of the explosive charge in the "toe" chamber. The advantages of this method are that in conjunction with Cordeau fuse, the explosive charge can be broken at intervals and at any point in the borehole to give the desired results; the explosive force is distributed over a greater length of the borehole; a minimum of loss of efficiency, due to cleavage planes or fissures; at least 10 per cent. greater efficiency; full control over the blast; complete detonation of explosives and only one detonator being required independent of the number of boreholes in the blast.

Although stone is being produced at a high tonnage per lb. of explosives in big blasts, it is anticipated that with larger blasts—50,000 tons or more per blast—which will be the board's future aim—a still greater saving will be made in costs by the increase in tonnage per lb. of explosives.

A Bucyrus drag-line and three Ruston steam shovels—each 1½ c. yd. capacity—load the stone from the quarry face into trucks, which are conveyed by two locomotives to the breakwater. Here, the body of each truck is lifted and tipped by a large electrically operated telpher crane, 17 tons maximum load, manufactured by the Perry Engineering Co., Adelaide.

The resident engineer (Mr. H. G. Jenkinson) will adhere to the original method of blasting by column loading in conjunction with Cordeau detonating fuse as supplied by Nobel (Aust.) Pty. Ltd., with the addition of drilling deeper boreholes 3-ft. below quarry floor level.

Impending Port Developments at Sunderland.

Sir George Gillet, the recently-appointed Commissioner for Special Areas, visited Sunderland recently and made a tour of observation in respect of three schemes of port development in which the Corporation and the River Wear Commissioners are jointly interested. The first scheme is for land reclamation at the South Docks, the second for the construction of a new fish quay and the third for the erection of a cold store as an additional facility at the Corporation Quay. Altogether, the three schemes are estimated to cost in the neighbourhood of £200,000.

The land reclamation scheme was first submitted to the former Commissioner for Special Areas, some three years ago. It involved the building of a breakwater from the Hendon sea frontage across to the protection works of the Hendon Docks for the purpose of enclosing an area which could be filled in and used for dock extension purposes. On the occasion of its first promulgation, the Commissioner offered a grant of 33 per cent. towards the estimated cost of about £350,000, and it is hoped that in its modified form a higher percentage grant will be obtained.

The project of a fish quay has been before the Port Authority for some time, dating back to the days of the old fish quay, which was put out of commission by the closing of the south outlet of the docks during the war. Prior to the construction of the new Corporation Quay, the fish trade was accommodated at the Thornhill Quay, and when that site was appropriated temporary accommodation was found at a quay alongside the engine works of Richardsons, Westgarth and Co., Ltd. In the event of this firm's works being re-opened, the fish trade would be deprived of their frontage. The present proposal is to construct a new fish quay on the site of Holmes's Wharf, at present used by the Corporation for barging refuse out to sea. This is at no great distance from the Corporation Quay and would permit of the use of the intervening space at some future time for any necessary extension of the accommodation.

The River Wear Commissioners, who already have powers to provide a fish quay, have taken the matter up and are applying for a grant to the Commissioner, who is stated to be favourably impressed by the proposal, as also by the land reclamation scheme and the cold store project. All these matters are now under his consideration.

The Inland Port of Norwich and its Shipping

The Development of Coastal Trade

The following condensed extracts are taken from an address by Mr. W. J. Everard at a recent meeting in the Guildhall, Norwich:—

Seagoing Trade of the Port.

No figures showing the volume of sea-going cargoes brought to and from Norwich pre-war are available, but it is known that the revenue of the River Yare Commissioners from sea-going craft in 1905 was £44, and I have been given a figure of £70 as the revenue from sea-going ships going through to Norwich in 1913. These figures suggest that the number of sea-going vessels trading to Norwich in those years could not have exceeded 50 or approximately one a week, although the River Yare Commissioners have put the pre-war average number of vessels trading to Norwich at 150. Judged by my close knowledge of the traffic of the river, I cannot help feeling that this total must include some craft of a non-sea-going character, but if we take this outside figure the sea-going vessels trading to Norwich pre-war were at the most less than three a week. The number of sea-going vessels described by the River Yare Commissioners as "entering the Yare at Yarmouth and trading to and from Cantley or Norwich" for the year ended March, 1935, was 821; a little more than two a day, or over five times the pre-war total. The tonnage of these vessels totalled the impressive figure of 108,286 net registered tons. For the year ended March, 1936, the corresponding number of vessels was 763—a slightly lower figure. This was due to the increased size of trading vessels using the river. The comparative figure for 1934 was 694 vessels. In 1930 the number of vessels to and from Cantley and Norwich is stated to have been 304. For more convenient reference I have put these figures into the following table:—

Year	No. of Vessels	Percentage Increase over Pre-War
Pre-War Average	150	—
1930	304	103
1934	694	363
1935	821	447
1936	763	409

I have already explained the reason for the lower figure in 1936 over 1935. It is important to add that the pre-war average figure of 150 is not only an outside estimate but refers to very much smaller vessels with a considerably lower cargo carrying capacity than the vessels using the river to-day.

The adoption of the grid system for the supply of electricity and the fostering of the home production of sugar beet have been material contributory factors in the development of the shipping trade of the port. Messrs. J. and J. Colman may be called the pioneers in the restoration of the river traffic; they were the first of the local merchants to build facilities for the reception of water-borne goods. Those concerned with the welfare of Norwich as a port must also recognise the enterprise shown by the Norwich Corporation in establishing river-side wharves enabling them to obtain coal in large consignments for which coastwise traffic is both economical and convenient and to the sugar beet factories and to other private merchants who have provided the necessary facilities for the discharge of water-borne coals and other traffic.

Nature of Waterborne Commerce.

The water-borne trade of Norwich is, of course, in the main import traffic. According to the figures of the River Yare Commissioners the principal import cargoes for the years ended 24th March, 1935 and 1936, were as follows:—

	1935	1936
Coal (Tons) ...	157,455	161,335
Grain (Qrs.) ...	102,222	117,675
Cement (Tons) ...	5,900	6,536
Bricks (Nos.) ...	2,349,500	655,000
Tiles (Nos.) ...	1,831,150	2,043,785

Other import traffics included paper, wood, rice, flour and mustard seed. It is to be noted that the imports of coal, grain, cement and tiles all increased last year. The higher cement imports indicate the steady growth of the district and the development of housing schemes.

The export traffics to Norwich and district during these two years were sugar, molasses, scrap iron and mustard cake.

The figures which I have quoted both as regards numbers of vessels and volume of cargo do not include the important inland water transport trading between Great Yarmouth and Norwich operated by the tugs, lighters and wherries of the Yarmouth Shipping Company, Messrs. J. and J. Colman and the oil companies.

Motor Vessel Development.

Another and most important contributory fact in the growth of the port is the introduction and expansion of the small motor vessels. In 1903 the late Mr. Arthur Collins propounded a scheme for the improvement of the river involving an expenditure of some £210,000 which was, of course, based on pre-war cost; the figure would have been trebled to-day. With such an expenditure he visualised the navigation of the river by "small steamers of ordinary coasting type up to 350 or 400 tons and of special type to 600 tons . . . ." which he felt would "require a channel having a minimum depth of 15-ft. at high water ordinary tide." To meet the progressive needs of the coasting trade British Coasting owners are keeping their tonnage and methods up-to-date, and have taken the fullest advantage of the development of the Diesel engine by providing shallow draft motor vessels as opportunity occurs. These motor vessels require only about 18-in. to 2-ft. more water than the 150 to 180-tons sailing ships trading to Norwich before the war. The present motor vessels are able to carry 600 tons of cargo at a time to Norwich without the necessity of extensive and costly engineering works being undertaken on the lines envisaged by Mr. Arthur Collins. I think it is true to say that, apart from dredging, little expenditure has been incurred by the navigation authorities having jurisdiction over the River Yare in recent years and perhaps I may be forgiven if I claim for British shipowners a substantial part in the growth of the sea-borne trade of Norwich. My firm had the distinction of building the first British motor coaster in its yard at Greenhithe and I believe also of sending the first motor ship to Norwich with a cargo of port wine. The number of small British motor ships on the United Kingdom register is now about double what it was a few years ago. The loaded draught of many of the motor ships at present trading to Cantley and Norwich is about 10-ft., while the draught of some of the sailing ships trading to Norwich as far back as 1903 required 8 to 9-ft. of water. We have, therefore, trading to Norwich to-day vessels of the size contemplated by Mr. Collins navigating a 10-ft. channel instead of one of 15-ft., which Mr. Collins, in 1903, thought to be necessary. The development of the Diesel engine for marine purposes has opened up a new era for up-river traffic.

Prevention of Obstructions to Waterborne Traffic.

Although we have seen this definite and satisfactory progress in the trade of Norwich in the past few years, it is earnestly hoped that the several interests concerned will not rest content, and will all do what they can further to increase the sea-borne traffic. In the first place it is obviously important that nothing should be done which will place obstructions or handicaps in the way of developing the traffic. The Dock and Conservancy Authorities and the Shipowners' Organisations have to be keenly on the alert to avoid the adoption of proposals which involve the likelihood of interference with navigation, and a tendency, in recent years, to multiply bridges or tunnels crossing estuaries or navigable rivers has needed careful watching. We already have five bridges from the sea to Norwich, viz., Yarmouth Bridge and the bridges at Breydon, Reedham, Trowse and Carrow. While those responsible for the navigation of the Yare at the time these bridges were built took considerable care to secure swing or lifting bridges, there is room for distinct improvement in the arrangements for the opening of the bridges for the passage of vessels. Any delay to the progress of vessels up and down the river is a serious matter to the trade of Norwich.

Speed Control.

Sea-going vessels can only enter and leave the discharging berths at Norwich at high water or at the most approximately one hour or so—depending on the size of the boat—before and after high water. For this and other reasons shipowners viewed with alarm a recent proposal of the East Norfolk Rivers Catchment Board, which has jurisdiction over the river for draining purposes, to control the speed of vessels using this river, as well as the Rivers Waveney and Bure. It was gratifying to find the Great Yarmouth Port and Haven Commissioners taking such an active part in opposing this proposal, and the Chamber of Shipping giving the Commissioners their support. Everyone will recognise that both the Catchment Board and the Harbour Commissioners have important functions to perform, and the agreement reached between the interests, following the Public Enquiry held at Norwich in October and December last year, for the setting up of a Consultative Committee of the Commissioners and the Catchment Board was a happy and sensible arrangement. It ought not to be difficult for the Catchment Board and the Harbour Commissioners to agree upon improvements to the river which will at one and the same time assist the navigation of vessels and improve the drainage outfall.

The Inland Port of Norwich and its Shipping—continued

Port Improvements.

In my view it would help to maintain and improve the trade of the port if a lock were constructed well down the river—the further the better, say 6 or 7 miles from Norwich. This would enable " a fine head of water " to be retained in the upper reaches of the river. It would avoid groundings to vessels which occur on certain states of the tide to-day and increase the frequency and speed of the service which the shipowner could provide. Vessels proceeding from sea to Norwich cannot always reach their discharging berths on the first flood tide after arriving at Yarmouth, owing to the absence of navigation lights in the river and to the limited speed at which they can safely proceed. It often happens that a vessel only carries its high water to within 2 or 3 miles of the Norwich berths, with a resulting loss of 12 hours, or even 24 hours if the next tide is a dark night tide. Further, the construction of a lock which would maintain an even level of water would go a long way towards preventing the present erosion of the banks in the upper reaches of the river. Though experts differ, I am convinced that this erosion is caused almost entirely by the rise and fall of the tide, and not from the wash of commercial vessels.

The suggestion which was made at the recent Catchment Board Enquiry for the establishment of a turning or swinging place for vessels in the vicinity of Cantley would also be helpful. A similar turning place could, with advantage, be constructed just below the present berths at Norwich itself. Such turning or swinging basins would, to a material extent, save valuable time in the handling of vessels—not only those actually swinging but to other craft waiting to pass up or down the river, and would remove any further cause for apprehension on the part of the Catchment Board of damage by vessels to the banks during the operation of turning.

Value of Coastwise Shipping.

The development in the sea-borne trade of Norwich is an example which it is earnestly to be hoped may be followed in other parts of the country. Much has been said and written of the importance to Great Britain of its shipping. His Majesty's most gracious speech at the opening of the present Parliament on the 3rd November contained a reference to the necessity of maintaining an adequate Mercantile Marine. Coastwise shipping not only constitutes an important branch of British shipping, but is also an essential part of the internal transport system of the country. Successive responsible Ministers of the Crown and others have testified to the national importance of coastwise shipping. One of the most recent and impressive statements was made by Sir Julian Foley (then Mr. E. J. Foley) the head of the Merchantile Marine Department of the Board of Trade in 1929, when giving evidence on behalf of the Board before the Royal Commission on Transport. He said:—

> " . . . It must be borne in mind that the existence of an efficient and adequate coasting service is of manifest importance, especially in time of war or civil emergency. The carriage of coal and other bulk and general cargoes, and the distribution of food discharged at the larger ports from ocean-going ships to smaller U.K. ports, depend upon coastwise shipping. As almost every large centre of population in the U.K. is situated at or near the sea, the freest, most flexible and most economical distribution of the material of industry and the means of maintaining life is impossible without full use of sea transport round the coasts.
>
> " Coasting shipping must not, therefore, be allowed to be crippled by either railway or road competition, since in emergency the railways and the roads cannot alone meet the needs of the situation."

It was recognised by the Transport Commission, to which their statement was made, that " it is impossible to dissociate coastwise shipping and ports, since the latter form the link—the physical junction as it were—between transport by sea and transport by land. Without shipping, the port is useless; without the port, shipping is helpless; their fortunes are inextricably bound together. . . "

In the last few years British coastal owners have been much encouraged by the interest which a number of eminent public men have taken in the maintenance and development of the coasting trade and the smaller ports. Through a body called the Coastal Trade Development Council these public-spirited gentlemen have done much to educate the public as to the national importance of coastwise shipping, and I should like to take this opportunity—the matter is of just as much importance to the ports as it is to coastal shipping—to express the indebtedness of all interests to Lord Cork (who visited the City of Norwich on 22nd September and toured the waterside), the President of the Council, to Sir John Wardlaw-Milne, M.P., the Chairman and to Commander Marsden, the Vice-Chairman for their interest in the welfare of the coastal trade and the ports which it serves.

Improvement of the Lesser Ports.

Engineering experts who recently made a survey of the coast of the United Kingdom on behalf of the Coastal Trade Development Council came to the conclusion that of the 162 lesser ports which they examined a considerable proportion could, with comparatively little expense, and largely by reason of the development of the power driven coaster, be brought up to one of two standards of greatly increased efficiency, capable of accommodating respectively vessels of 14-ft. and 10-ft. draught at all states of the tide.

If a general scheme of improvement to those standards were found to be practical, its significance would be stupendous in relation both to national emergency and the dispersal of the present traffic congestion by land, and it certainly ought not to be overlooked in the present troublous times. Norwich would be brought into direct communication with all these ports as the type of craft now trading to Norwich would be enabled to navigate to and from them all. Many of these ports are linked up by branch railway lines or secondary roads with the main traffic arteries of the country. Their restoration, coupled with the development of coastal shipping, would quickly bring into use hundreds of miles of branch lines and branch roads for the intake and distribution of food stores and other cargoes. The mass targets offered to enemy aircraft by traffic concentration in and around the major ports of the country would thus be dispersed.

The time appears to be ripe for a great national move towards the development of the lesser ports and coastal shipping as a means of making the fullest use of our historic coastal lines of communication. For many years past the lesser ports have largely been neglected. Traffic congestion by land, the coming of the motor coaster and the vital defensive needs of the country justify energetic action in this direction.

I read the other day that £13,000,000 in loans have been poured into the film industry in ten months by British financial institutions. If a similar sum had been invested in port improvements, I venture to suggest this would have been of far greater national value.

Somebody has lately been telling certain public bodies and the general public that we cannot afford to specify " ship British " in local authority contracts as an antidote to the growing encroachment of foreign ships in the United Kingdom Coasting Trade, because there are not sufficient British ships of modern type to take the traffic offered. Such excuses are absolute nonsense. Given assurances of fair play and of freights that will permit that continued employment of all British crews and the maintenance of British wage standards, British ship owners can provide all the ships required.

Port Grouping.

Some suggestions have been made in the past months for grouping ports in areas under one Central Authority. Not unnaturally the proposal springs from those connected with the larger ports. I see real dangers in the grouping idea. Broadly speaking, the major part of the revenue of the large ports is derived from goods which pass over the quays; the cargoes which are trans-shipped overside from the ocean-going ship to the coasting vessel do not receive the same facilities from the Port Authority, and quite properly do not contribute to the same extent as the cargo which is landed on the quay. In these circumstances a Central Authority would tend to give more consideration to what can be termed the " direct " rather than the " transhipment " trade. Further, if the small ports under a system of Port Grouping were called upon to pay even a relatively small proportion of the running and executive costs which are necessary in the administration of a large port it might have very harmful effects on the coastal services. Any general adoption of this principle would, to my mind, be more likely to bring about the death of many of the small ports than their development, which, as I have suggested, is of such vital national importance. The effect would be the loading up of more traffic on the roads and the removal of any possibility there might exist for developing the areas surrounding these small ports.

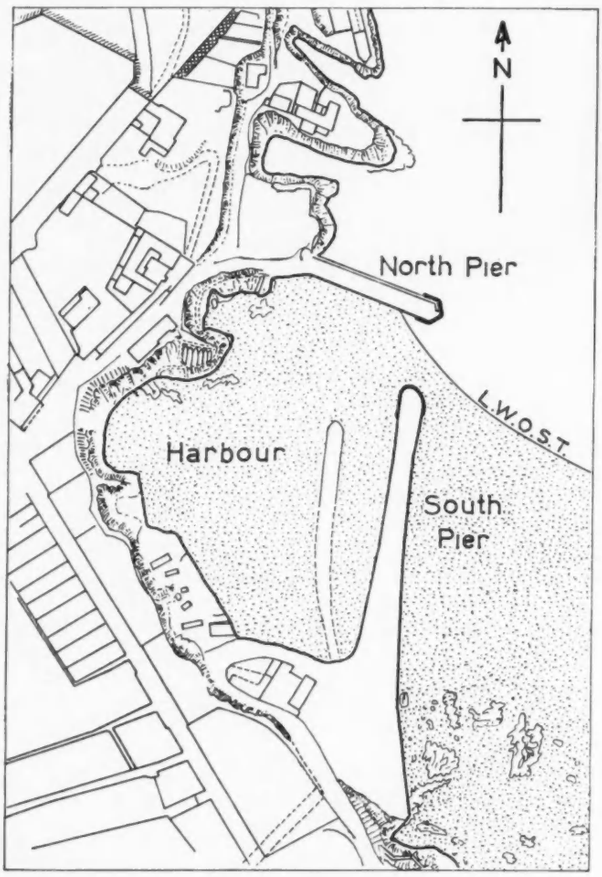
Development of Coastal Trade.

When it is borne in mind that the modern class of shallow draft motor coastal vessel, which has done so much to improve the trade of Norwich, is suitable for and in many cases in fact does trade to-day to up-river ports, such as Selby and York in Yorkshire; Maidstone in Kent; as far as Kingston-on-Thames in Surrey; to Rye, Arundel and Lewes in Sussex; to Newport, I. of W.; to Eling and Totton in Hampshire; to Wareham in Dorset; to Penryn and Truro in Cornwall; to Bideford and Barnstaple in North Devon and to Bridgwater in Somerset, you can well understand my anxiety that nothing should be done which would be at all likely to restrict the development of this class of traffic.

The Reconstruction of Entrance Piers at Newquay Harbour

THE two piers forming the entrance to Newquay Harbour have been in existence for over a hundred years, and consist of two masonry walls with rock and rubble filling between them. The walls are of the gravity type but of very slender section. Moreover, at the seaward ends of the piers the foundations are not carried down to the rock, which occurs 6-ft. below the harbour bed; they merely rest on the sand overlying the rock, no provision being made to retain the sand under the walls or to protect their foundations from scour except by a shallow apron of concrete at the outer end of the South Pier.

The harbour at Newquay is not very exposed, and for a long time the piers withstood the storms fairly well. During the last ten years, however, it became clear that the foundations were being undermined and that protective measures on a fairly large scale would have to be undertaken to prevent further scour. This applied particularly to the inner wall on the South Pier, where the masonry had bulged forward and settled.



Key Plan of Harbour.

A scheme was accordingly drawn up for strengthening the foundation of the wall by driving a line of sheet piling at a distance of 4-ft. in front of it. Larssen section No. 1GB was selected, the intention being to drive cross walls of piling every 12-ft., and to provide temporary steel trench sheeting along the face of the wall, thus forming a series of small rectangular cells. The sand in the cells would then be excavated and replaced with concrete, the work being carried out at low tide only as the scheme provided for permanent piling 10-ft. long with temporary lengths of only 6-ft. fishplated to them.

Whilst the detail drawings were being prepared, a storm of unusual severity caused a section of the South Pier to collapse thus making complete reconstruction necessary. At the same time it became clear that protective measures would also have to be applied to the remainder of the foundations of the outer portion of the South Pier, and also to those of the North Pier.

The revised scheme was also based to a great extent upon the use of Larssen piling, both for reasons of economy and because the work was likely to be carried out more quickly than with other forms of construction. The latter was of particular importance as after the initial collapse further portions of the pier were being damaged by every storm. It was decided

Breach in South Pier.

to construct a new wall across the breach, using Larssen Section No. 2 in lengths of 28-ft., the piling being carried up to nearly the full height of the pier. The piling penetrates several feet into the shellate rock which underlies the harbour bed; little difficulty was experienced in driving the piling to the necessary level, as this type of rock is comparatively soft and was found to powder under the rapid succession of blows delivered by the No. 7 McKiernan-Terry hammer which was used.

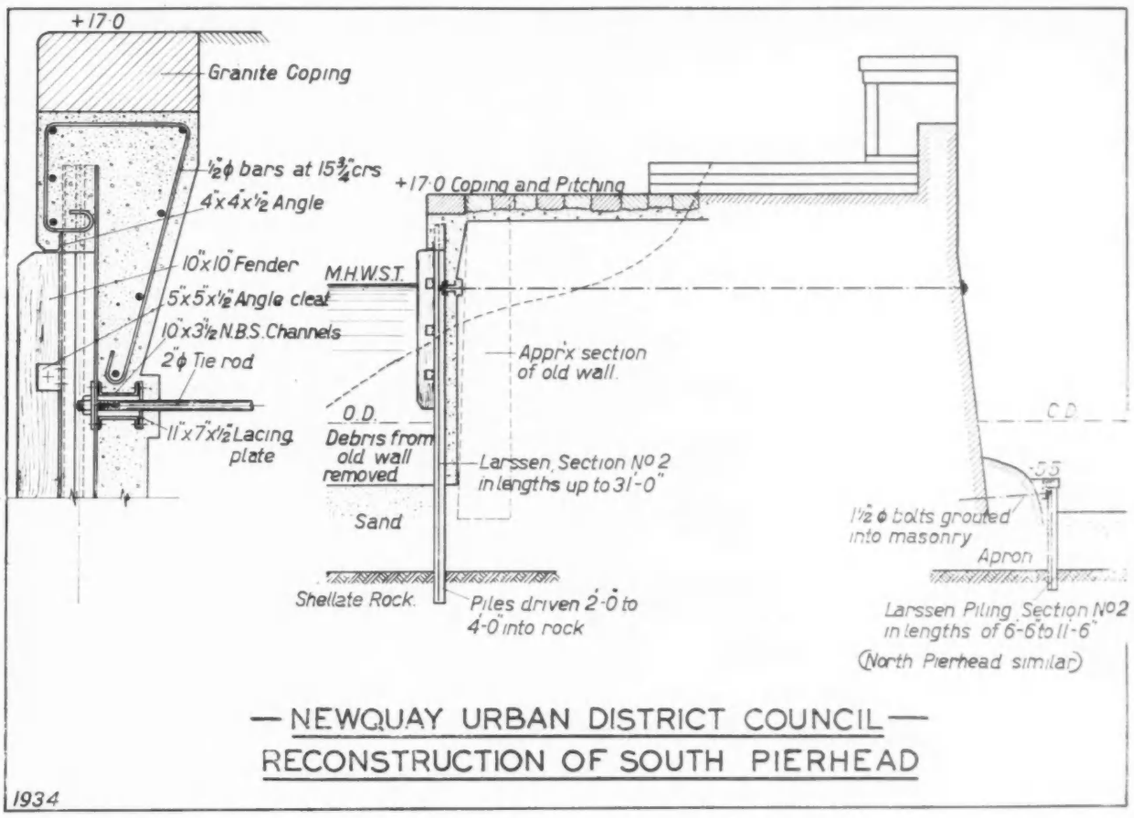
The stability of the new wall of Larssen piling is ensured by the tie rods which are carried right across the pier and are fixed to large washer plates bearing on the outside of the masonry. A bulb-headed rail encircling the pier helps to distribute the pressure of the anchor plates and also adds to the security of the pier as a whole.

In other respects the design of the wall of piling follows the usual practice, a waling of two steel channels being provided along the back to concentrate the load from individual piles at the tie rods. Renewable timber fenders bolted to angle cleats rivetted to the piling, are fixed to the front of the wall.

Debris being cleared from front of piling driven across breach in South Pier.

The remainder of the outer ends of the South Pier and also that of the North Pier, are protected by a curtain of Larssen Section No. 2 in various lengths, driven just in front of the wall footings. These piles also penetrated the rock to the required depth without difficulty, and are fixed to the wall foot-

The Reconstruction of Entrance Piers at Newquay Harbour—continued



ings by tie rods grouted into the masonry. The small space between the piling and the wall was filled with concrete, and the whole of the masonry joints then pointed.

After the completion of this work cement and sand grout was injected into the pier heads through numerous drill holes under an air pressure of 10 lbs. to 20 lbs. per sq. inch, 280 tons of cement being used. In this manner the undamaged parts of the outer ends of the two piers were protected at comparatively small expense from possible future undermining and failure.

The work described above was carried out to the designs of Mr. N. G. Gedye, M.Inst.C.E. The original scheme for the protection of the pier drawn up by Mr. J. C. Ennor, a local consulting engineer. The contractors were A. Jackaman and Son, Ltd., of Slough. The piling was supplied by The British Steel Piling Co., Ltd., Thames House, Millbank, London, S.W.1.

New Mammoth Excavator

Even in this era of gigantic engineering appliances, a new excavator which has just started work in America calls for comment. This machine, known as a 950-B, was made by the Bucyrus-Erie Company, of South Milwaukee, U.S.A., which is associated with Ruston-Bucyrus, Ltd., of Lincoln, and has been put into service by the Binkley Coal Company, of Indiana, on its coal stripping operations near Terre Haute.

In operation the new giant with its 30 cubic yard dipper lifts 40 to 45 tons of material at each cut or cycle. Its size is reflected in the fact that it can dump its load of spoil further and higher than any other shovel in the world has ever been able to dump. The mammoth machine has a new type of boom 105-ft. long, a tubular dipper arm 64-ft. long, a maximum dumping height of 70-ft., a cutting radius of 115-ft. and a dumping radius of 106-ft. Supposing a football field

with a 950-B in the centre, the machine could dig 40 tons of material from one touch-line and dump it almost to the other up to a height the equivalent of a 7-storey building.

Speed is another feature in which the 950-B is notable. It has a very fast digging cycle which, on large projects, means a considerable saving in stripping costs. The entire digging cycle takes less than one minute, and this enables an output of 2,000 to 3,000 tons per hour to be obtained, equal to the work of about 4,000 men if the distance the material is transported is also taken into account.

The machine is electrically driven, under the control of one man, who sits in his control cab at the height of a 3-storey building. At his finger tips are the controls for 32 different electric motors used in the various operations of travelling, levelling, digging, slewing and dumping. These motors range in size from ¼ h.p. to one of 1,000 h.p. Enough power is required for these motors to supply the requirements of a large sized town.

Custom of the Port for Wood and Grain Cargoes at Antwerp

The following extract is made from the January Monthly Circular of the Baltic and International Maritime Conference.

Contrary to what is the case in some other countries, the stipulation in charter-parties that the cargo shall be loaded or discharged according to the custom of the port refers in Belgium, not only to the mode and manner of handling the cargo, but to the daily quantity loaded or discharged.

This gives rise to disappointments and miscalculations in two respects in particular, namely for the discharge of wood cargoes and of grain cargoes at Antwerp. Besides the reason already stated, namely the rule in other countries, the explanation is that owners are accustomed to consider Antwerp as a modern port, with good facilities for handling cargo, and in the majority of cases their expectation of good despatch is fulfilled. On the basis of this experience owners have no hesitation in agreeing to the stipulation that the cargo shall be discharged according to the custom of the port in the belief that, if this stipulation should refer to the quantity, it will, in any case, be a quantity compatible with the good name and reputation of the Port of Antwerp.

The difficulties arise whenever there is congestion at the port, or if receivers for some reason that suits their own convenience desire to slow down the discharge. In that case they are able to invoke customs of the port laying down the daily quantity to be discharged and agreed upon between the Chambre de Commerce and the Fédération Maritime d'Anvers.

For wood cargoes the customs are

Norway and the Baltic.

(1) Cargoes consisting of at least 80 per cent. deals and battens:

(a) 3 stds. per hour and per hatch for the entire cargo, if the remaining 20 per cent., or less, consist of boards of 1-in. and over.

(b) Otherwise 3 stds. for the deals and battens and 2 stds. for the balance.

(2) Average Cargoes of deals, etc.:

(a) 2½ stds. for deals, battens and boards, boards being understood to be ⅝ths-in. thick and 4-in., or more, wide.

(b) 2 stds. for ⅝-in. by 3½-in. and less.

(c) 2 stds. for staves.

(3) Cargoes of boards:

If full cargoes of small boards ⅝-in. are shipped the dimension ⅝-in. by 4-in. shall be considered as small boards and the entire cargo shall be received at the rate of 2 stds. per hour per hatch.

White Sea.

(a) 2½ stds. per hour and per hatch when the cubic of the cargo consists of less than 50 per cent. of wood of less than 1-in. thick.

(b) 2¼ stds. when the cubic of the cargo consists of more than 50 per cent. less than 1-in. thick.

General Conditions.

(a) All bundled wood shall be considered as boards and be discharged at the rate of 2½ stds.

(b) If one hold is much larger than the others, receivers have the right to calculate the lay days on the largest hold.

(c) The agreement is not applicable unless the captain can deliver the quantities stipulated.

For props, the agreed quantity is 25 fathoms per hatch per day, but this is possibly not of quite the same importance as the custom for sawn wood cargoes, because charterparties for prop cargoes usually stipulate the actual quantity beforehand.

It is important to pay regard to the general conditions as they have the effect of further reducing the average quantity. If one hold is much larger than the others, receivers have the right to calculate the time allowed on the basis of the quantity in this hold, and not on the average quantity based on all the holds. The same applies to prop cargoes.

In actual practice, the daily quantity is sometimes calculated at an average rate of, say, 20 stds. per hatch, multiplied by the number of hatches, and if the time allowed in this manner is exceeded, demurrage is paid.

Owners cannot claim, however, that this method shall be applied, and if it suits receivers' convenience they can calculate the time as stipulated in the customs.

This is not the only difficulty. It is often taken for granted that the customary daily quantities shall be regarded as minimum quantities, and that if there is any delay in the course of discharge, for instance, on account of congestion, owners will be able to obtain demurrage.

Formally, this is not the case. The legal position appears to be so complicated that, if receivers choose to do so, they can escape liability for time lost unless captains watch the discharge all the time and protest if less is discharged during any one hour from the particular hatch through which the quantity is discharged that forms the basis of calculation. It will readily be understood that it is a difficult matter for captains to establish whether less than 2½ stds. is discharged during one hour. Little short of complete stoppage will be required to enable the captain to protest.

Moreover, deck cargoes are often discharged at one berth and cargo from the hold at another, and compensation for the delay arising in shifting or even in commencing to discharge at the second berth cannot be claimed from receivers if this delay is not considered to be their fault.

A judgment was rendered a short time ago according to which the Court of Appeal at Brussels reversed a judgment of the lower instance concerning the calculation of the time allowed when the charterparty stipulated a definite quantity per hatch per day. The quantity stipulated was the one laid down in the customs of the port, namely 20 stds. per hatch, and the time was calculated on the basis of the quantity contained in the largest hold. The judgment of the Court of Appeal was that the time allowed should be calculated on the basis of 20 stds. multiplied by the number of hatches.

The following are the points in regard to which the alteration of the customs of the port is desirable:

(1) the commencement of the time counting after the arrival of the vessel, which should be simultaneously with the beginning of the first working period, irrespective of the cause of delay, if any, that is to say, after noon, when the vessel arrives in the morning and notice is given before noon, and next morning, if the vessel arrives in the afternoon, always provided that time shall count if the discharge is commenced sooner.

(2) that time used in shifting from the berth where deck cargo is discharged to subsequent berths even if shifting is ordered by the harbour master, shall be counted as time used, and the cost incurred in shifting shall be paid by receivers.

(3) that even if the daily quantity of 20 stds. per hatch is retained as a minimum quantity, it shall be understood as an average quantity calculated on the basis of the number of hatches. Demurrage to be paid if the total time allowed is exceeded. Receivers should be urged, if possible, to agree to an increase of the minimum quantiy.

For grain cargoes the following quantities are laid down:

Cargoes	Wheat (usual perc. bags)		Other Grain and Seed bulk or bags		
(tons of 1,000 kg.)	without or with one elevator	with more than one elevator	without elevator	One elevator	more than one elevator fexcl. oat cargoes 1,000 t. or more)
200	100		100		
400	150		150		
600	200		200		
800	250		250		
1,000	250		250		
1,001 – 2,000	400	800	300	350	650
2,001—3,000	550	950	450	500	800
3,001—4,000	650	1,050	550	575	875
4,001—5,000	675	1,075	575	650	950
5,001—5,500	720	1,120	625	700	1,000
5,501—6,000	850	1,250	675	800	1,100
6,001—& above	1,000	1,400	765	900	1,200

As will be seen, these quantities are far below the despatch that would be expected at Antwerp, and also far below what owners actually reckon with and normally obtain, in fact, these quantities are applied only to suit receivers' convenience. It is suggested that they should be increased so that they become average rather than minimum quantities.

Publications.

We have received from H.M. Stationery Office a copy of the Fourth Report to the President of the Board of Trade on the work of the Tramp Shipping Administration Committee. The Report shows very fully what has been achieved and what an extraordinary change for the better has taken place during the last two years. Although this partial recovery is encouraging, there is still much lee-way to be made up and further assistance is still necessary.

Copies of the Report (price 4d., postage extra) can be obtained from H.M. Stationery Office at any of the following addresses:—Adastral House, Kingsway, London, W.C.2; 120, George Street, Edinburgh, 2; 1, St. Andrew's Crescent, Cardiff; York Street, Manchester, 1; 80, Chichester Street, Belfast; or through any bookseller.